

Open Research Online

The Open University's repository of research publications and other research outputs

A conceptualisation of psychological access to the Internet : adolescents, gender and attitudes

Thesis

How to cite:

Sunley, Tracey Ann (2006). A conceptualisation of psychological access to the Internet : adolescents, gender and attitudes. PhD thesis The Open University.

For guidance on citations see [FAQs](#).

© 2006 The Author



<https://creativecommons.org/licenses/by-nc-nd/4.0/>

Version: Version of Record

Link(s) to article on publisher's website:

<http://dx.doi.org/doi:10.21954/ou.ro.0000d64f>

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

oro.open.ac.uk

**A Conceptualisation of Psychological Access to the Internet:
Adolescents, Gender and Attitudes**

Tracey Ann Sunley B.Sc. (Hons.)

Submitted for the Degree of Doctor of Philosophy in Educational Technology at the
Open University, Milton Keynes

March 2006

AUTHOR NO M9409465
DATE OF SUBMISSION 22 MARCH 2006
DATE OF AWARD 14 SEPTEMBER 2006

ABSTRACT

This thesis describes the conceptualisation of a construct proposed here as *Psychological Access to the Internet* and presents the development and testing of an instrument to measure the construct amongst adolescent children in informal voluntary contexts at home and school. The rapid growth and permeation of ICT across UK society, particularly in education, has raised the question of whether previous gender inequities observed in relation to computers will transfer onto new media such as the Internet. This inequity has serious implications for individuals' full social, educational and professional participation.

In order to conceptualise the construct fully, exploratory and investigative survey (n=109) studies, followed by an interview study (n=30), researched and identified attributes theorised as contributing toward the overall construct. This was followed by a survey of 729 adolescent children, in which an instrument grounded in the previous studies was tested. The relationship of gender, Internet experience and context of use was examined with regard to measurement of psychological access to the Internet.

Examination of the psychometric properties of the instrument established that it successfully demonstrated discriminative validity. Factor analysis identified convergent validity for scale items across three dimensions, suggesting three discrete subscales: Internet Confidence, Personal Relevance of the Internet, and Internet Friendship. A second-order factor analysis found one underlying factor, establishing that the instrument was measuring a global construct, investigated and defined by this thesis as psychological access to the Internet.

The findings of the research carried out for this thesis show that gender, experience and context of use are important variables in the measurement of psychological access

to the Internet. The continuing relevance of this thesis in light of educational policy in the UK is put forward.

CONTENTS

Abstract	i
Contents	iii
Figures.....	xi
Tables	xiii
Preface and Acknowledgements	xv
Chapter One	1
1 Introduction	1
1.1 Background to the Thesis.....	1
1.2 Aims of the Thesis	2
1.3 Overview of the Thesis	2
1.4 Definitions.....	5
1.4.1 Gender	5
1.4.2 The Internet	6
1.4.3 Psychological Construct.....	6
1.5 Summary	7
Chapter Two.....	9
2 Literature Review.....	9
2.1 Introduction	9
2.2 ICT in Education.....	10
2.2.1 Role of the Internet in Education	10
2.2.2 Advance of Computers in Schools.....	12

2.2.3	Evidence for a Continuing Attainment Gap.....	15
2.2.4	Pupils' ICT Attainment at Key Stage 3	15
2.2.5	GCSE and A-Level	16
2.2.6	Undergraduate Level.....	18
2.2.7	Postgraduate Level.....	21
2.3	Professional Presence.....	22
2.4	Access to Information and Communication Technology.....	23
2.4.1	Physical Access to Information and Communication Technology.....	24
2.4.2	The Rise of Domestic Access to ICT.....	25
2.4.3	Formal Access to ICT	27
2.4.4	Informal Access to ICT.....	28
2.5	Psychological Aspects of Access to ICT	32
2.5.1	Attitudes and Computers.....	33
2.5.2	Gender Stereotypes	40
2.6	Gender and Types of ICT Use	47
2.7	Gender and the Internet.....	51
2.8	Continuing Policy Relevance.....	60
2.9	Summary and Conclusions.....	64
Chapter Three		67
3	Design and Methodology	67
3.1	Introduction.....	67
3.2	Overall Design of the Study (Conceptual Framework).....	68
3.2.1	'Grounded Theory'.....	68
3.2.2	Data Collection Methods.....	69
3.2.3	Qualitative Approaches.....	71

3.2.4	Quantitative Approaches.....	71
3.2.5	Sampling	72
3.3	Data Collection Tools	72
3.3.1	Observation	72
3.3.2	Interview	73
3.3.3	Questionnaire	74
3.4	Development of the PAtI Scale.....	74
3.5	Effect Size.....	76
3.6	Summary	77
Chapter Four		79
4	Exploration of Gender and ICT	79
4.1	Introduction.....	79
4.2	The Field Visits	79
4.2.1	Context.....	80
4.2.2	Procedure.....	80
4.2.3	Data	81
4.3	Field Study Results	82
4.3.1	Confidence	82
4.3.2	Relevance	83
4.3.3	Situation	84
4.3.4	Internet Enthusiasm.....	85
4.3.5	Internet Use	86
4.3.6	Home Access to ICT	87
4.3.7	Games.....	88
4.3.8	Informal School Access	88

4.4	Summary of Field Visits	89
Chapter Five		97
5	Investigation of Gender and ICT.....	97
5.1	Introduction	97
5.1.1	Survey Design	97
5.1.2	The Questionnaire	98
5.2	Survey Procedure	104
5.3	Survey Participants.....	105
5.4	Background to Survey Analysis.....	105
5.5	Survey Results – Categorical and Descriptive Results	106
5.5.1	Computer Access at Home.....	106
5.5.2	Participants General Access to a Computer at Home	106
5.5.3	Extent of Real Computing Access in the Home	107
5.5.4	Real ownership of the computer in the home.....	108
5.5.5	Participants’ Internet access at home	109
5.5.6	Extent of Media Technology Ownership	109
5.5.7	Preferred Uses of Computers and the Internet	111
5.5.8	Types of Computer Use at Home.....	112
5.5.9	Preferred Uses of a Computer	112
5.5.10	Favourite Uses of the Internet.....	112
5.6	Survey Results - The Internet Attitudinal Scale.....	114
5.6.1	Reliability.....	114
5.6.2	Principal Components analysis	115
5.6.3	Oblique Rotation	116
5.6.4	Interpretation of the Components.....	116

5.6.5	Component Correlation Matrix	117
5.7	Multivariate Analysis of Component Scores	118
5.7.1	Multivariate Results	118
5.7.2	Summary of Multivariate Results	121
5.8	Gender Stereotypes of a Typical Internet User	122
5.8.1	Analysis of the Stereotype Section	123
5.9	Summary and Discussion	128
Chapter Six		134
6	Interview study of girls' and boys' attitudes and uses of ICT	134
6.1	Introduction	134
6.2	Focus of the Interview Study	134
6.3	Participants	135
6.4	Interview Procedure	136
6.5	Interview Analysis	137
6.6	Results of Background Data	137
6.6.1	Computer in the Home - Access	138
6.6.2	Internet Access	140
6.6.3	Summary of Physical Access	140
6.7	Dedicated Games Machine Ownership	141
6.8	The Interviews	141
6.8.1	Capabilities, Confidence and Risk Taking	142
6.8.2	Effect of Situational Context	144
6.8.3	Boys' Domination of Facilities	145
6.8.4	Perceptions of Valid Computer Use	145
6.8.5	World Wide Web Choices	147

6.8.6	Future Work Intentions and the Internet	148
6.8.7	Future Voluntary Use of the Internet	148
6.9	Discussion and Conclusions.....	150
Chapter Seven		155
7	Main Study.....	155
7.1	Introduction.....	155
7.2	Design	156
7.3	The Schools.....	157
7.3.1	Orange School (ICT-rich)	157
7.3.2	Blue School (ICT-rich)	158
7.3.3	White School (ICT-poor)	158
7.3.4	Yellow School (ICT-poor)	158
7.3.5	The Sample.....	159
7.4	The Survey Instrument.....	159
7.4.1	Introduction.....	160
7.4.2	Section 1	160
7.4.3	Section 2.....	161
7.4.4	Section 3.....	161
7.4.5	Section 4.....	163
7.5	Administration of the Survey Instrument.....	163
7.6	Survey Analysis	164
7.7	Results.....	165
7.7.1	Participants.....	165
7.8	Results of Categorical Analyses.....	166
7.8.1	Gender and Voluntary Use of the Internet at School	167

7.8.1.1	Gender and Location of Voluntary Internet Use at School.....	168
7.8.1.2	Gender and Type of Voluntary Internet Use at School.....	168
7.8.1.3	Gender and Frequency of Voluntary Internet Use level at School	171
7.8.1.4	Summary of Voluntary Internet Access at School.....	172
7.8.2	School Identity and Participants' Internet Access at Home.....	173
7.8.3	Gender and Internet Access at Home.....	173
7.8.4	Gender and Location of Internet Access at Home	174
7.8.5	Gender and Types of ICT Use at Home.....	175
7.8.6	Gender and Games Use of the Internet at Home.....	175
7.8.7	Gender and WWW Use at Home.....	176
7.8.8	Gender and Frequency of Internet Use at Home.....	177
7.8.9	Summary of Internet Access and Use at Home	178
7.9	Attitudinal Scale.....	179
7.9.1	Reliability.....	179
7.9.2	Principal Components analysis	180
7.9.3	Second Order Analysis.....	185
7.10	PAttI Score Analyses In Context	187
7.10.1	Children Attending an ICT-poor School.....	187
7.10.2	Children Attending an ICT-rich School.....	191
7.10.3	All Participants.....	197
7.10.4	Participants' Access to the Internet and PAttI Scores.....	203
7.11	Summary Overview	204
7.12	Conclusions and Discussion.....	209
Chapter Eight	216
8	Conclusions	216

8.1	Introduction.....	216
8.2	Achievements.....	216
8.3	Implications for Education.....	222
8.4	Implications for Policy.....	223
8.5	Limitations of the Research	225
8.6	Further Research	226
8.7	Summary.....	228
	References	230
	Appendix A - ICT Questionnaire.....	247
	Appendix B - Technology Questionnaire	251
	Appendix C – Internet Questionnaire (ICT-poor schools).....	252
	Appendix D – Internet Questionnaire (ICT-rich schools).....	256
	Appendix E – Coding Schedule	262
	Appendix F – Publications.....	264

FIGURES

Figure 2.1	UCAS Applications for Computer Science degrees and HND courses	
1997-2004	20
Figure 2.2	Students Undertaking Computer Science Undergraduate and	
Postgraduate Degrees 2003-04.....		21
Figure 2.3	ICT Facilities Available to Pupils Out of School Hours.....	30
Figure 5.1	Scree Plot	115
Figure 5.2	Gender and Computer/Internet Presence: Interaction for Confidence	
Score	121	
Figure 5.3	Example of a Response Rated as a Female Person	124
Figure 5.4	Example of a Response Rated as a Male Person	124
Figure 5.5	Example of a Response Rated as a Neutral or Ambiguous Person	125
Figure 5.6	Relative Distributions of Internet User Stereotypes	126
Figure 6.1	Ownership of Computer in Interviewees' Homes	138
Figure 6.2	Main Computer Users.....	139
Figure 6.3	Location of Computer in Interviewees' Homes	140
Figure 7.1	Gender and Use of the Internet at School in Own Time	168
Figure 7.2	Use of Internet at School for Games	170
Figure 7.3	Use of Internet at School for WWW-browsing.....	171
Figure 7.4	Gender and User Level at School	172
Figure 7.5	Location of Internet Access at Home.....	174
Figure 7.6	Use of the Internet at Home for Games	176
Figure 7.7	WWW Use at Home.....	177
Figure 7.8	Gender and User Level at Home.....	178
Figure 7.9	Scree Plot	182

Figure 7.10 Mean PAttI Scores for User Level at Home: Children Attending ICT-
poor Schools 191

Figure 7.11 User Level at Home of Children Attending ICT-Rich Schools 196

Figure 7.12 Significant Univariates for Gender200

Figure 7.13 Internet Confidence for School Type201

Figure 7.14 Significant Univariates for User Level at Home.....202

Figure 7.15 User Level at Home and ICT-rich/ICT-poor school attended Interaction
for Internet Confidence203

TABLES

Table 1.1	Overview of the Research Phases	8
Table 2.1	Children's Performance at Key Stage 3 in Information Technology	16
Table 2.2	Pupils Achievement at GCSE in ICT.....	17
Table 2.3	Computer Science and ICT entrants at A-level.....	18
Table 2.4	Percentage of Households in 2002 with a Home Computer and Internet Access	26
Table 2.5	Students' Frequency of Use of Computers and the Internet at School	52
Table 2.6	Students' Type and Frequency of Use of ICT by Gender	53
Table 2.7	Students' further Use of ICT by Type and Gender	54
Table 5.1	Number of Participants in Survey	105
Table 5.2	Location of the Computer in Pupils' Homes	108
Table 5.3	Ownership of the Computer at Home	109
Table 5.4	Media Technology in Participants' Bedrooms.....	111
Table 5.5	Favourite Uses of the Internet	113
Table 5.6	Items and Loadings for Component 1	116
Table 5.7	Gender and Individual Dependent Variable Scores	119
Table 5.8	Computer/Internet Access: Confidence Score	119
Table 5.9	Computer/Internet Access: Gender and Confidence Interaction Scores...	120
Table 5.10	Distribution of Girls' Internet Stereotypes across School Year Groups.....	127
Table 5.11	Distribution of Boys' Internet Stereotypes across Year Groups.....	127
Table 6.1	Interviewees	136
Table 6.2	Interviewees Ownership of a Dedicated Games Machine	141
Table 6.3	Future Internet Use Intentions.....	149

Table 7.1	Participants.....	165
Table 7.2	Total Variance Explained.....	181
Table 7.3	Pattern Matrix.....	183
Table 7.4	Correlations	186
Table 7.5	Loadings from Second Order Factor Analysis.....	187
Table 7.6	Gender Mean Scores for ICT-poor Schools.....	189
Table 7.7	School Identity Mean Scores for ICT-poor Schools.....	189
Table 7.8	User Level at Home Mean Scores for ICT-poor Schools	190
Table 7.9	Gender Mean Scores for ICT-rich Schools.....	192
Table 7.10	School Identity Mean Scores for ICT-rich Schools.....	193
Table 7.11	User Level at Home Mean Scores for ICT-rich Schools	194
Table 7.12	User Level at School Mean Scores for ICT-rich Schools.....	195
Table 7.13	Gender Mean Scores for All Participants	198
Table 7.14	ICT-rich/ICT-poor Mean Scores for All Participants.....	198
Table 7.15	User Level at Home Mean Scores for All Participants.....	199
Table 7.16	User Level at Home and ICT-rich/ICT-poor school Interaction.....	202
Table 7.17	Access to the Internet and Mean PAttI Score	204
Table 8.1	Psychological Access to the Internet Questionnaire	221

PREFACE AND ACKNOWLEDGEMENTS

The work for this thesis spanned an eight year period, during which illness twice interrupted progress towards final submission. Despite this, the findings and theory presented here continue to have relevance. The progress and change in relation to ICT seen in educational policy, work place practice and society generally, have essentially served to heighten the current significance of this work.

I would like to sincerely thank and acknowledge the role of many wonderful people who have contributed towards the completion of this thesis:

My supervisors, Pat Fung, Sara Hennessy and John Richardson, who have offered their unstinting support, guidance and mentoring, much beyond the ordinary. Each has additionally contributed in extra special ways; Pat, for her encouragement and pastoral care through black times; Sara, for the invaluable quality of her observations and persistent faith in me; and John, for his analytical clarity, continued patience and enthusiastic responses to my many questions.

My children, David, Andrew, James and Alexander, who have long inspired in me a fascination and wonder for the development of the human mind and the uniqueness of individuals; their progression through life continues to bring me joy, pride, and yet still more new ideas to ponder.

Christopher Sunley, whose tremendous support, encouragement and love has been constant and strong throughout the writing of this thesis. His untiring and generous contribution here is beyond measure.

My friends, Doug Clow and Richard Joiner, for lending their invaluable support, encouragement, and constructive critical feedback.

Also, I would like to acknowledge and thank the teachers and pupils of the schools who welcomed me and allowed the research necessary for this thesis to be carried out.

Finally, I am most grateful to the Institute of Educational Technology at the Open University, who provided the initial scholarship and enabled me to embark upon this journey.

I dedicate this thesis to my parents, Elizabeth and Frederick Howlett.

CHAPTER ONE

1 INTRODUCTION

1.1 Background to the Thesis

The research for this thesis is concerned with the conceptualisation and measurement of the construct of psychological access to the Internet amongst adolescent children in the United Kingdom, in which it is argued that individuals' attitudes influence their voluntary participation in the use of Information and Communications Technology (ICT). The concept is explored and developed over three studies, culminating in a major survey to measure the construct and its relationship to gender, physical access, experience and context of use.

The increasing importance of ICT to education brings to the fore questions relating to equity of provision and participation. The rapid infiltration of physical provision of ICT across state schools in the United Kingdom has provided not only the conditions for increased embedding of ICT into and across curriculum subjects, but also a new potential dependency upon the medium. In anticipation of this, the impact upon individuals, in terms of their equity of participation, needs to be considered.

Relative participation, evidenced by the degree of presence of girls and women in voluntary situations, presents a *prima facie* case for inequity. Individuals are at risk in terms of educational participation and opportunities in their social and professional lives. Previous research with computers suggests inequities have arisen historically that are linked to gender, attitudes and experience; whether negative outcomes associated with these factors will also be related to the future forms of ICT is a matter for contemporary researchers.

This thesis focuses upon the Internet as the dominant ICT medium, seeking to present a conceptualisation of the construct *psychological access to the Internet* and to measure the impact of this upon individuals.

1.2 Aims of the Thesis

The implications of inequities in ICT in terms of social and economic participation ultimately impact upon society as a whole. Such differences may be challenged by policy and provision. However, they will not necessarily be *resolved* simplistically. Research is necessary to examine specific influential factors in order to identify and propose potential solutions. The aims of this thesis were:

- To explore the place of the Internet in children's lives.
- To identify potential elements contributing to a construct of psychological access to the Internet in real everyday situations.
- To establish the contributions of specific elements towards the construct.
- To develop a measure of the construct.
- To apply the measure to investigate the relationship to gender, voluntary contexts and experience.

1.3 Overview of the Thesis

Chapter 2 reviews the research from the fields of ICT in Education and Psychology relating to gender differences. The review consists of five main areas. Firstly, the educational landscape providing the backdrop to this thesis is presented and relevancies put forward. Next, the evidence for a problem of attainment affecting individuals' educational and professional lives in relation to gender and ICT is identified. Following this, there is a critical examination of what is meant by 'access', from a concrete physical perspective, in terms of both formal and informal situations. In the fourth

section, the roots of psychological access to the Internet are identified and critically examined in terms of the differences that have been associated with gender in relation to computers. This encompasses the contribution of stereotypes, attitudes, computing confidence, and computing experience towards behaviour, capability and motivation to engage with computers. Lastly, the contemporary position with regard to gender and Internet use is scrutinised, in both formal and informal contexts, and the case for the continuing relevance of this thesis is put forward.

The review identifies a gap in the literature in which there is a failure to address the potential relevance of *voluntary* access to ICT and the implications of this for experience and attitudes. It concludes with a proposition of the concept of psychological access, which, it argues, can be inferred from individuals' attitudes and expressed behaviours and intentions. As a result of the review of the literature the primary research question driving this thesis was identified:

Will the inequity of psychological access demonstrated in a substantial body of research into gender differences in attitudes and computers in education be repeated in relation to adolescents' use of the Internet?

Chapter 3 describes the overall rationale, design and methodologies involved in this thesis for identification of the factors contributing towards a construct of psychological access and the development of an appropriate instrument with which to measure this.

Chapter 4 describes a preliminary exploration into the conceptualisation of a model of psychological access to the Internet. The study explored and developed an initial picture of the place and role of ICT and the Internet within adolescent school pupils' lives through observations and informal interviews in a school context. It identified key issues relating to gender and ICT: confidence, relevance, context of use, access and type of use.

Chapter 5 describes an investigative survey (n=109) including an attitudinal scale. The study was designed to discover potential components contributing towards the development of a defining construct of psychological access. It identified key themes and issues relating to gender and ICT, indicating areas for further focus, and tested a potential measure of psychological access to the Internet.

Chapter 6 provides an account of an interview study (n=30), which was designed to explore in more depth key themes and issues emerging from the investigative study. These related to gender and matters of perception, use, and intent to use, computers and more specifically the Internet, principally in voluntary contexts.

The interview study identified the need to research further into the impact of gender upon psychological access to the Internet, in relation to the choice of individuals to use and appropriate the medium according to their needs and desires in voluntary contexts, and identified the importance and implications of this for formal learning environments such as schools. Key facets of psychological access to the Internet were identified and labelled: future self, social self, confident self and reactive self.

The main study reported in Chapter 7 investigated and measured the concept of psychological access to the Internet, in both informal home and school situations where Internet use is voluntary, for example during lunch breaks. It scrutinised the potential effects of gender, Internet experience and context of use. Four secondary schools took part: two with an ICT policy in place to permit children Internet access outside lessons and two without such a policy. The study further developed a detailed conceptualisation of the construct and successfully tested a measurement instrument grounded in the preceding research, in everyday voluntary domestic and educational contexts, using a sample of 729 adolescent children.

The research questions addressed in the final study were those relating to reported behaviours potentially linked to psychological access to the Internet:

- Is gender an important variable in the take-up of the Internet in informal contexts?
- Is gender an important variable in the type of use of the Internet in informal contexts?
- Is gender an important variable in the extent of use of the Internet in informal contexts?

And those designed to draw out the latent attitudinal aspects of the construct:

- Is there an effect of gender on a measure of psychological access to the Internet?
- Is there an effect of context on a measure psychological access to the Internet?
- Is there an effect of experience on psychological access to the Internet?

Chapter 8 describes the achievements of the research carried out for this thesis and the implications of this for research, education and policy. The limitations of the research are outlined and further research possibilities are considered.

1.4 Definitions

The following sub-sections define gender, the Internet, and psychological construct, as interpreted and referred to in this thesis.

1.4.1 Gender

The term ‘gender’ is used in this thesis to distinguish beyond a simplistic interpretation of sex differences as a biological distinction at either a macro or micro level, and seeks to further incorporate a recognition of the sociocultural distinctions which may be made on the basis of behaviours and characteristics seen as more appropriate to men and women (Richardson, 1997). The contextual cues and influences that impact upon

interpretation and categorisation of an individual as belonging to one group or another draw upon common cultural understandings and acceptances within societies and situations; these differences are more fully captured by the term 'gender differences' than 'sex differences'. For the purposes of this thesis, therefore, gender is the preferred term of use for this body of work.

1.4.2 The Internet

The Internet refers to an immense public network of millions of computers across the world, via which any computer can communicate with any other on the network in an interconnected information exchange. It is a distributed system, wherein a computer on the system can act independently of another, selecting services to use, and consists of many networks within networks, encompassing academic, commercial, domestic and government networks (Webopedia, 2005). Examples of information and services include e-mail, online chat, instant messaging and documents published via the World Wide Web (WWW).

The term WWW is sometimes used synonymously with the Internet, but actually refers to a particular use of the Internet to access and share information in a common format using hypertext transfer protocol and hypertext markup language (Webopedia, 2005).

1.4.3 Psychological Construct

Psychological constructs are latent and not directly observable. They are abstract notions which require indirect methods for measurement. Cronbach and Meehl defined a construct as a:

postulated attribute of people, assumed to be reflected in test performance. In test validation the attribute about which we make statements in interpreting a test is a

construct. We expect a person at any time to possess or not possess a qualitative attribute (amnesia) or structure, or to possess some degree of a quantitative attribute (cheerfulness). A construct has certain associated meanings carried in statements of this general character: Persons who possess this attribute will, in situation X, act in manner Y (with a stated probability)...The constructs in which tests are to be interpreted are certainly not likely to be physiological. Most often they will be traits such as "latent hostility" or "variable in mood", or descriptions in terms of an educational objective, as "ability to plan experiments".

(p.283, 1955)

Thus, the conceptualisation of a psychological construct is concerned with exploring and defining the attributes contributing towards its make-up and seeking to establish the effects of such a construct. The parameters and content of the construct are established and their impact in specified situations can then be examined.

1.5 Summary

The aims of the research studies carried out for this thesis were to identify the factors contributing towards an overall construct of psychological access to the Internet, to develop an appropriate instrument with which to measure this in respect of adolescent children, and then to apply and test it in context.

This thesis therefore proposes a construct of Psychological Access to the Internet (PAttI) in which it is argued individuals' attitudes influence their voluntary participation with the medium.

The focus of this thesis is the relationship between PAttI, gender, and informal access to and use of the Internet. Table 1.1 presents an overview of the phases of the research carried out for this study.

Table 1.1 Overview of the Research Phases

Phase	Date	Activity
Exploratory Study Chapter 4	January, February & March 1998	Field observations Informal interviews
Survey Study Chapter 5	September-November 1998	Survey (n=109)
Interview Study Chapter 6	February, March & May 1999	Interviews (n=30)
Main Study Chapter 7	December 2000 - January 2001	Major Survey (n=729)

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction

At the commencement of this review of the literature in 1998 prior to the study detailed in Chapter 4, the reported research relating to an effect of gender, pertaining specifically to the Internet rather than computing, was negligible. In order to examine variables potentially having a relationship with gender and engagement with the Internet it was therefore necessary to look primarily at the Internet's logical forerunner in this context, the computer. Later research, relating to ICT and the Internet, is examined in section 2.7.

The review which follows consists of five main areas relating to gender and Information and Communications Technology (ICT). Firstly, the educational landscape providing the backdrop to this thesis is presented. This provides the context in which the importance of the issue of gender and access to the Internet is addressed.

Next, the evidence demonstrating a problem of educational and professional attainment in relation to gender and ICT is laid out. This is followed by an examination of what is meant by the term *access*, from a concrete physical perspective, in terms of both formal and informal situations.

In the fourth section, those elements relevant to a concept of access, but not directly observable, are considered. It is here that the roots of psychological access to the Internet are identified and examined in terms of the differences that have been associated with gender in relation to computers. This encompasses the contribution of stereotypes, attitudes, computing confidence, and computing experience, towards behaviour, capability and motivation to engage with computers.

The final section looks at the contemporary position with regard to gender and Internet use, in both formal and informal contexts, providing the case for the continuing relevance of this thesis. It is argued that there is a need to acknowledge the influence of gender upon individuals' motivation and willingness to access Internet provision in voluntary situations, and the outcomes consequent to this.

2.2 ICT in Education

This section sets out the educational background against which this thesis was produced, one in which equitable access to ICT with regard to gender and the realisation of individuals' full potential in this area was, and is, an issue for prime consideration. This concern is no longer simply confined to the relatively narrow area of computers *per se*, but has increasingly ubiquitous implications. ICT is now highly pervasive throughout our society; consideration of the expectations, skills and needs of individuals is becoming more essential than ever before.

2.2.1 Role of the Internet in Education

The aim of the current United Kingdom government to produce an information and communication network, the National Grid for Learning (NGfL, 2005) intra and inter schools (DfEE, 1997a) promised changes to our perception of the media through which learning and teaching can be accomplished. It also added a whole new dimension to the processes of learning which are, it can be argued, proving analogous to the differences between oral and written literacy, both historically and between some contemporary societies.

It can be contended that the Internet is the contemporary equivalent to the emergence of the written word, with all the concurrent implications associated with the rise of a new psychological tool. Whilst the potential for positive gains, educationally

and socially, are immense, there remains a real danger that previous inequities of opportunity will be reproduced in new forms. It is only a generation ago, for example, that it was considered perfectly legitimate for state schools in the United Kingdom to offer a restricted curriculum to pupils based purely upon their biological sex.

What, then, was the perceived role of ICT within the education system? The Stevenson Report (1997), resulting from the Independent Information and Communications Technology in School Commission 1996/7, initiated by Tony Blair and David Blunkett whilst the Labour Party were in opposition, presented an analysis of the role desirable for ICT in primary and secondary education. The authors outlined a vision in which:

All young people - whether they have access to ICT at home or not- should be able to apply a basic confidence and competence in the use of ICT to all aspects of their learning experience..... We wish to see a society within ten years where ICT has permeated the entirety of education (as it will the rest of society) so that it is no longer a talking point but taken for granted - rather as electricity has come to be (p.4).

Information and Communications Technology in UK Schools: an independent enquiry.

Retrieved 22nd August 2005, from:

<http://rubble.heppell.net/stevenson/ICT.pdf>

Given the relationship between gender and inequities with respect to ICT, expanded upon later in this review, the need to carry out relevant research is one of importance. It is necessary to know if previous inequities of participation in the area of information technology are to be replicated in the new age of computers within education, with all the consequences that would derive from this. These outcomes relate to individuals'

lost educational opportunities, restricted career options, and an inability to participate and contribute to society via the medium of the Internet, to their fullest potential.

An increasing role intended for the use of the Internet in education is evident. There is a discernable shift in Government from mere Internet connectivity towards wide bandwidth connectivity, broadband, and interactivity, thus extending the potential range of applications in education and promising to permeate all areas of the curriculum.

The visionary paper *Transforming the Way We Learn* published in January 2002 (DfES, 2002b) presented broadband connectivity as a crucial element for the development of an integrated ICT model of learning with content-rich resources:

In schools it will enable: effective access to the Internet and high quality digital resources as and when they are needed; distributed learning, including the delivery of master classes to pupils in several schools simultaneously (no page number).

Retrieved January 2002, from:

<http://www.dfes.gov.uk/ictfutures/ictfutures.pdf>

The heightened integration of, and expectations for, the Internet in education, again draw attention to the need to consider those factors impacting upon equity of participation by individuals; in particular, gender, which has been found to be a sensitive factor with computers and ICT generally as will be discussed.

2.2.2 Advance of Computers in Schools

The growing emphasis upon the use of ICT in schools is illustrated by the statistics which follow, demonstrating the increasing acquisition of hardware and, more recently, the development of related network infrastructures.

Information provided by the DfEE Statistical Bulletin for ICT in schools in England (DfES, 2002a) reported that in 1984-85, the ratio of pupils to computers in secondary schools was 60:1. Computer provision grew rapidly, and by 1998 there were 9 pupils per computer at secondary level and 18 pupils per computer at primary level. These figures reflect computers used mainly for teaching and learning, rather than management and administration.

By 2002 (DfES, 2002a) the figures for computers in school had jumped considerably further; on average there were 6.5 pupils per computer at secondary level, with 10 pupils per computer at primary level. This ratio had fallen still further by 2003, with 7.9 pupils per computer at primary level and 5.4 at secondary level (DfES, 2003). Figures for 2004 (DfES, 2004a) show yet further reductions to the number of pupils per computer used for teaching and learning; 7.5 and 4.9 for primary and secondary levels respectively.

During the period 1998 to 2003, the DfEE/DfES Statistical Bulletins for ICT in Schools in England reflected the rapid changes in the focus of ICT use in schools. Data collection expanded to include information such as the number of multimedia computers and networked computers within schools. An Internet connection was available in 17% of primary schools and 83% of secondary in 1998 (DfEE, 1998). By 2003, 99% of all schools had Internet connectivity (DfES, 2003).

The next move was towards broadband connectivity, expanding the speed and breadth of Internet access available to schools, thus increasing the educational potential of the Internet further. By June 2003, broadband connectivity, defined by the DfES as at least 2Mbps or faster, had reached 26% of primary schools and 91% of secondary schools (personal communication from Senior Education Officer, DfES, 14th June,

2003). Broadband speed is measured by the rate of data transfer in Megabits per second (Mbps).

These descriptive statistics pointedly illustrate the rapid growth of ICT in education and the growing shift in perceptions about how it can be facilitated. It seems improbable that there has been a medium with such impact over such a short period of time, comparable to that of ICT. The nearest analogy to this is possibly the relative impact of dissemination of information via the printed word over handwritten and oral communication. Negroponte in *Being Digital* (1995) points to the crucial leap to what he describes as a post-information age, in which the growth of mass media and availability to audiences is complemented by increasingly individualised - *personalised* – information:

True personalization is now upon us. It's not just a matter of selecting relish over mustard once. The post-information age is about acquaintance over time: machines' understanding individuals with the same degree of subtlety (or more than) we can expect from other human beings, including idiosyncrasies (like always wearing a blue-striped shirt) and totally random events, good and bad, in the unfolding narrative of our lives.

Being Digital: Part Three Digital Life, The Post-Information Age: Cyberdock Version.

Retrieved 17th January, 2005, from:

<http://archives.obs-us.com/obs/english/books/nn/ch13c01.htm>

What is not apparent from the figures illustrating the rapid growth and development of infrastructure, is the degree of actual engagement with ICT at the level of individuals. The following section examines the evidence for an effect of gender upon educational and professional attainment relating to ICT.

2.2.3 Evidence for a Continuing Attainment Gap

The first issue considered here is the evidence for an educational gender gap in relation to computers and equitable participation, extending across at least the previous two decades and which is still present today. Recent evidence suggests, moreover, that the situation is not just failing to improve but is actually becoming worse.

Next, the issue of girls' elective choices is considered. Girls can be seen to continue to opt out of *voluntary* participation with ICT in educational situations and this consequently impacts on their progression towards higher levels within the workforce, in terms of opportunities, promotion and salaries.

2.2.4 Pupils' ICT Attainment at Key Stage 3

The route that leads to professional participation by women in ICT-related study and careers can be seen as an increasingly narrow path through the educational journey (Camp, 1997), one which appears to become particularly salient around the onset of adolescence.

An examination of performance at Key Stage 3 (pupils aged 11 – 14 years) of the National Curriculum (NCOnline, 2005) shows a persisting gender difference in children achieving Level 5 or above in Information Technology (DfES, 2004b). At this point in their educational career Information Technology is part of the compulsory curriculum. Table 2.1 illustrates this; girls consistently outperformed boys in the period 1999 to 2004.

Table 2.1 Children's Performance at Key Stage 3 in Information Technology

Year	Boys %	Girls %
2004	63	71
2003	63	71
2002	62	70
2001	61	69
2000	59	66
1999	56	62

2.2.5 GCSE and A-Level

In 2003, the Qualifications and Curriculum Authority (2004) reported that at GCSE level boys continued to outnumber girls in entering for the GCSE ICT course. QCA noted a clear need to increase the rate of take-up of ICT qualifications by girls. The girls that did follow the GCSE ICT course, however, achieved higher levels of attainment than the boys.

Despite girls' relatively greater success at Key Stage 3, boys choosing to enter for examination at GCSE level remained typically around a third higher in numbers than entries by girls across the years from 1999 to 2003. Table 2.2 gives the figures for pupils attempting examination in ICT at GCSE level for this period. When girls chose to enter for examination, they were gaining slightly higher levels of pass rates overall and were more likely to gain a top grade.

It can be seen therefore that a substantial proportion of girls are electing to withdraw at age 14 from participation in the examination arena of ICT, thus narrowing future options and possibilities. Even though they have successful ICT assessments at Key Stage 3, something is happening to discourage them from continuing to higher levels; this is at a point where they are able to make choices, probably for the first time, about whether to continue to engage with ICT study or not.

Table 2.2 Pupils Achievement at GCSE in ICT

Year	Numbers Entered		A* - C		A* - G	
	Boys	Girls	Boys %	Girls %	Boys %	Girls %
2003	44 000	30 000	54	62	94	96
2002	60 000	41 000	54	63	94	96
2001	59 000	40 000	54	60	95	96
2000	52 000	34 000	52	60	96	97
1999	46 000	31 000	51	59	95	97

At A-level, Computer Studies gained in popularity over the period 1995 to 2001. Boys still accounted for around two thirds of examination entrants in 2001, with a rate of increase that continued to outpace girls (DfES, 2005b). Achievement levels between boys and girls were similar in the top three grades. Most recent figures (DfES, 2005b) show that Computer Science and ICT entrants at A-level are still overwhelmingly male, although pass rates are comparable between the sexes, as illustrated in Table 2.3.

Table 2.3 Computer Science and ICT entrants at A-level

Computer Science and ICT entrants at A-level	Male Entrants	Female Entrants
2003 Computer Science Entrants aged 18	714	92
2003 Computer Science Passes aged 18	86.1%	85.9%
2004 Computer Science Entrants aged 16-18*	8448	976
2004 Computer Science Passes aged 16-18*	78.1%	72.2%
2003 ICT Entrants aged 18	1361	500
2003 ICT passes aged 18	85.2%	87%
2004 ICT Entrants aged 16-18*	14209	8153
2004 ICT passes aged 16-18*%	76.6%	80%

(* the age groupings reported changed in 2004, therefore year comparisons cannot be made)

It can be seen that measures of attainment alone fail to tell the whole story of gender and ICT across statutory education. When girls do choose to sit GCSE and A-level in ICT related areas, their grades demonstrate their capability. However, scrutiny of the actual numbers of girls electing to sit such examinations, relative to boys, shows a substantial difference at the point where girls can voluntarily choose to participate.

2.2.6 Undergraduate Level

Firstly looking back across the last three decades, Dain (1991) highlighted the point that despite increasing participation by women in first degrees such as maths and science, candidates for computer studies in the United Kingdom declined, for example, from 24% in 1977 to 10% in 1987. This takes on even greater significance when we note that other subjects showed an increase; for example, engineering rose from 5% in 1977 to 11% in 1987. She outlined reasons for this decline, not only in terms of the male-

oriented ethos and nature of computing *per se* - 'no women here...no women wanted' - but also in the increasing masculinisation of computing courses and the subsequent failure to address 'the relation of computing to the real world'.

By 1996, the figures were still disproportionately low for women's participation in the area of ICT in comparison to men. Figures from the Universities and Colleges Admission Service (UCAS, 2005) for degree course applications in Great Britain during 1996, show that of applicants accepted for Mathematical sciences and Informatics, which includes maths, computer science and software engineering, women still only represented 20% of the total.

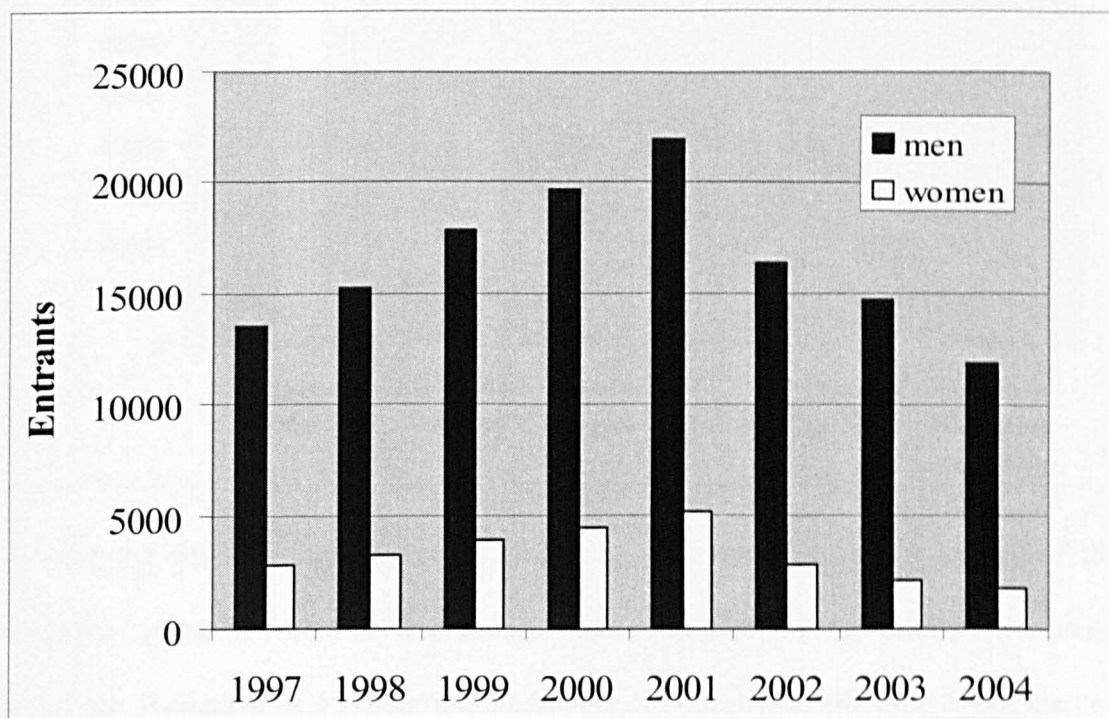
During the period of work for this thesis the picture remained largely unimproved. Figure 2.1 illustrates the UCAS figures for applications for Computer Science degrees and HNDs courses from 1997 to 2004. Overall, it can be seen that the gap in take-up between the sexes has failed to be narrowed; indeed, the relative ratios for the latter three years indicates a worsening situation.

The observable gender differences present in voluntary participation in ICT and Computer courses, as described in the previous subsections, have demonstrated a continuing issue across time. Yet, up to Key Stage 3, girls are performing well; the future divergence in engagement cannot therefore be attributed to a lack of ability impacting on choices. Indeed, when girls do continue to participate at GCSE they are still outperforming the boys, and at A-level are performing at similar achievement levels to the boys.

Richardson and Woodley (2003) investigated age, gender and subject taken, as predictors of performance of academic attainment in Higher Education. Although they found that women are more likely to achieve good degrees generally, 13 out of the 19 subjects considered, this did not hold true across all subjects. For computer science,

engineering and education, women were less likely to obtain a good degree compared to women taking the other subject areas. With respect to computer science, there was no significant difference between women and men in academic attainment. Therefore, when women do engage with computer science in higher education, it is not amongst their strongest subjects overall; however, within the subject of computer science there is no significant gender difference in actual attainment.

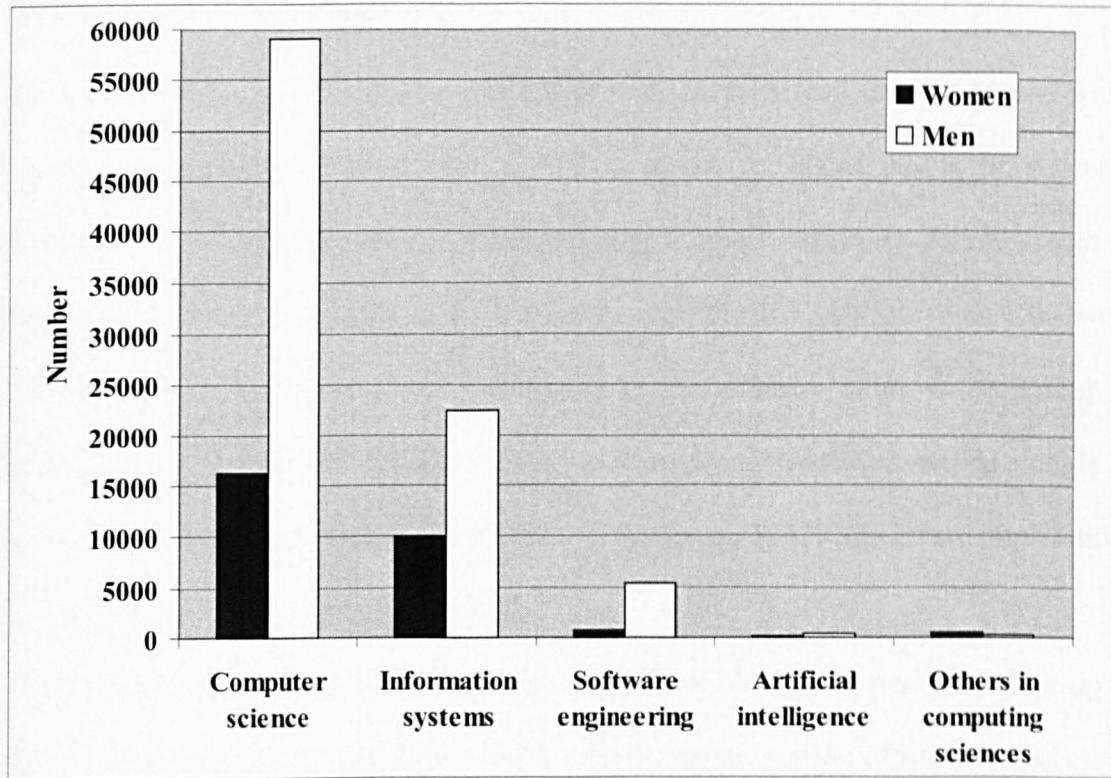
Figure 2.1 UCAS Applications for Computer Science degrees and HND courses 1997-2004



Looking at the latest figures available at the time of writing in 2005, the differential remains (UCAS, 2005). Despite increasing numbers of students in higher education selecting undergraduate and postgraduate degrees in the discipline of computer science, men continue to outnumber women. Figure 2.2 illustrates the gender breakdown and gives further information about the sub-domains included under the umbrella of

computer science in higher education. Previous years segmented subject information differently and data are not therefore directly comparable.

Figure 2.2 Students Undertaking Computer Science Undergraduate and Postgraduate Degrees 2003-04



Women are entering the field of ICT in smaller numbers across the course of their education, numbers which decline at each stage of academic progression. The evidence is not just indicative of a gender gap in respect of educational attainment, but also of a contraction of women's presence further up the levels of professional career development; they fade from the arena of participation.

2.2.7 Postgraduate Level

In the United Kingdom, women still only accounted for 29% of postgraduate qualifications in computer science in 2000 (HESA, 2003). Over the period 2000 to

2001, more women completed postgraduate qualifications in computer science, increasing numbers from 15,000 to 17,000. In contrast, the figures for men remained static; however, at 37,000, this was still at a substantially higher number than for women.

2.3 Professional Presence

The loss of women's participation impacts at both an individual level and upon wider society. For women, it marks the closing of doors to higher levels of potential participation in ICT-related employment, limiting promotional prospects and access to professional salaries. In terms of national economy, the ICT workforce is effectively reduced to a restricted pool of participants in the industry. This is becoming of increasing importance and relevance, with a shortage of suitably qualified people to draw upon (Greenfield, Peters, Lane, Rees, & Samuels, 2002) and it has implications for economic and innovative progress.

Despite an increase in ICT-related jobs of 50% in the 5 year period leading up to 2000, compared to a 7% workforce growth overall, the proportion of women workers in the industry declined from 25% in 1995 to 22% in 2000. Only 8% of workers in software engineering were women (Greenfield et al., 2002). In 2001, 83% of ICT managers were men and similarly 84% of software professionals were men (EOC, 2002).

Even when women do succeed at higher professional levels, the extent of 'leakage' and a retention failure mean that the problem perpetuates. Not only is there an ongoing loss from women's participation, but the initial pool of potential professional women is impacted by lower rates emerging from higher education in the first place (Greenfield et al., 2002).

This section has put forward the evidence for a gender gap in participation in ICT across time, educational and professional activity, identifying a gap which starts at the point of voluntary participation and persists despite equal capability. Next, the focus moves towards the literature examining gender and physical access to ICT.

2.4 Access to Information and Communication Technology

The concept of *access* to ICT provides the basis for this thesis. *The Compact Oxford English Dictionary* (2005) gives a definition of the noun usage of the word *access* as ‘the means or opportunity to approach or enter a place’, and ‘the right or opportunity to use something or see someone’. Used as a verb, the dictionary example refers to ‘gain access to’ or ‘make accessible’.

This thesis is concerned with the effect of gender upon adolescents’ access to the Internet, defined not only as the opportunity afforded by circumstance or policy provision, but also the opportunity to gain access associated with individuals’ attitudes and behavioural choices.

Gibson (1979) originally conceived the concept of ‘affordances’, actionable properties, describing the relationship between the world and an ‘actor’, that is a person or animal, suggesting that elements of both the environment and the individual are deciding factors for potential actions. This concept was applied and further developed by Norman (1988) in *The Psychology of Everyday Things*, which proposed that the affordances of a design enable an action but are also dependent upon the prior experience of the actor and their knowledge or culture. An example of an affordance in design according to Norman would be a door designed with a knob to open, or a finger plate to push, with the affordance providing a strong clue as to their operation.

Affordances in the external sphere can be physical, or abstractions, such as cultural frameworks.

In the case of ICT, access can be granted gender equitable affordances by means of physical provision, gender-considered policies, or the development of a zeitgeist in which it becomes a social norm. These external affordances cannot, however, act alone to ensure equity; they require the individual to perceive the potential as something they can personally action. The following sections therefore look at the concrete aspects of access, followed by those psychological aspects which afford access to ICT at the level of the individual.

2.4.1 Physical Access to Information and Communication Technology

Access, opportunity, or the right to use ICT, is impacted by several dimensions. These can include socio-economic (Rudd, 2002), geographic, age, and gender factors. A notion of equity underlies many concerns about access to ICT, with various initiatives emerging when the weight of concern drives a need to redress the balance.

The following subsections review the evidence for a gendered inequity of access to ICT in terms of physical circumstance and provision; in other words, an effect which is directly observable by one means or another. A later section examines access as individual, psychological attributes, to do with issues impacting upon computing usage which must be inferred or measured indirectly.

Physical access is firstly considered in terms of the evidence for the increasing provision and presence of ICT in contemporary society, followed by an examination of the formal and informal contexts of access.

2.4.2 The Rise of Domestic Access to ICT

The growth of ICT in Britain during the last twenty-five years has been exponential. The relative decline in costs has enabled the medium to make the transition from being the tool of high business to the new media in the home and the toy in the playground. An examination of the growth of Internet usage demonstrates this aspect.

During 1996 over 4.5 million people used the Internet in the United Kingdom (Cyberatlas, 1998). Use of the Internet in the home increased from 420,000 to over a million users over the same period, with women comprising 35% of participants.

The General Household Survey (National Statistics, 2006) carried out in the United Kingdom annually since 1971 found that ownership of a personal computer increased from 34% in 1998 to 54% by 2002 (National Statistics, 2002a). In 2001 the survey also began to ask respondents about Internet connectivity. In 2000 31% of all households surveyed accessed the Internet from a personal computer. By 2002, this had increased to 42%. In addition to the rapid growth of computer ownership and Internet connectivity, the demographics in terms of household are also of interest. Table 2.4 clearly shows a cohort effect, with the over 60s being the least likely to own a computer or have home Internet access. Households consisting of three or more adult individuals are shown as the most likely to have home computer and Internet access.

Table 2.4 Percentage of Households in 2002 with a Home Computer and Internet Access

Household Composition	One adult aged 16-59	Two adults aged 16-59	Small family	Large family	Large adult household	Two adults: one or both aged 60 or over	One adult aged 60 or over
Home computer	49%	69%	73%	76%	79%	33%	9%
Access to Internet at home	39%	60%	59%	57%	66%	27%	6%

Recent figures show that 55% of households in Great Britain had Internet from home in May 2005 (National Statistics, 2005b) and 55% of those connected in August 2005 were at broadband speeds.

This transformation has seen the infiltration of the medium into all areas of our lives and throughout many aspects of the workplace, domestic life, recreation and education. Yet the indications are that ICT, as an artefact of contemporary modern culture, is gendered as masculine (Leathwood, 1999; Yelland, 1999) and therefore by implication is primarily of territorial concern and interest to boys and men. Moreover children, particularly adolescents, see computers as belonging to a male province (Eastman & Krendl, 1987; Koohang, 1986; Siann, Macleod, Glissov, & Durndell, 1990). This poses a serious potential problem for equity of access and participation by girls and women in many areas of our society, particularly education.

Figures presented in this section demonstrate the rapid growth of ICT over a relatively short period. However, what they do not show are the details which would indicate individual access and use: who in the household has 'ownership' and how patterns of use potentially differ within a family.

2.4.3 Formal Access to ICT

A perception of computers and their use being ‘male territory’ has historically been given more impetus by the linking of computers with mathematics, which was seen to be an area of lesser interest and confidence for girls (Cockcroft, 1982). This was not only through the physical location of computers within many schools, but also linked to the mathematical background of many teachers of computing, reflected in the bias of uses to which the computers were put. This subsection considers the changing place of formal access to computers in schools as computers emerged from a strong association with mathematics into the wider curriculum.

The evidence suggests that by 1996 access to computers had escaped the mathematical domain. The DfEE Survey of Information Technology in Schools 1996 (DfEE, 1997b) reported that there was 37% access to computers within a dedicated computer room in secondary schools, with the rest distributed throughout the school. It is notable that the availability of computers within departments as a proportion of the total number of computers in schools was less in mathematics (20%) than in business studies (43%) or design and technology (37%). The relative proportions for computers within English departments (15%), history (9%) and art/design (16%) were still lower. By 2002, however, use of ICT to support various curriculum areas showed that 89% of primary schools made substantial use of computers to support English teaching, compared to 74% in maths (DfES, 2002b). At secondary level, the use of computers to support English was 56% compared to 60%.

Between 1998 and 2002 the average number of computers in primary and secondary schools increased by over 50% (DfES, 2002b), with the emphasis slowly shifting from computer facilities *per se* within schools, towards an expansion of networks and

increased Internet connectivity. This reflects the evolution of IT towards ICT and the growing importance, and reality, of Internet connectivity.

Whilst these figures are encouraging, suggesting that computers had indeed escaped the original link to mathematics and arguably, therefore, an automatic connection to the masculine, they do not elucidate on the extent of actual access by individual pupils within differing subject areas; they are only indicative of potential access.

The Qualifications and Curriculum Authority (2004) reported that only 10% of secondary schools surveyed modified their ICT curriculum to differentiate activities according to pupils' gender, needs and preferences. To put this into further context, it should be noted that this is the lowest percentage across all subjects and less than half of the next lowest subject. In other words, ICT is the subject least likely to be personalised to pupil level.

Although formal provision and access to computers within schools has increased overall, an effect of gender upon access outside of timetabled education, considered in the following subsection, does not appear to have diminished.

2.4.4 Informal Access to ICT

Informal access to computers is defined here as access which is achieved outside of timetabled school provision, the workplace, or other formal situations. Examples of informal access would include access to computers in the domestic environment, lunchtime access at school which is voluntary, or access in friends' homes.

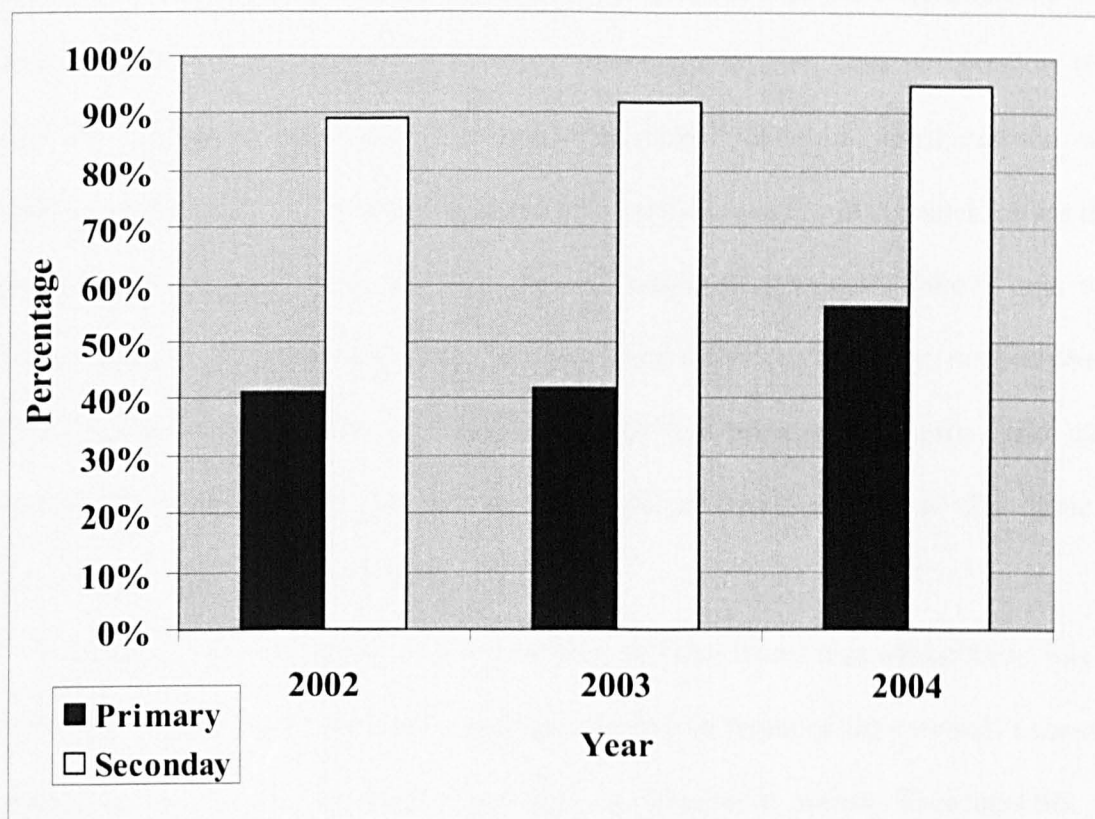
Murphy and Elwood (1998) put forward evidence to suggest an influence upon school learning, which originates from learning happening outside of school. This, they argue, originates from learnt gender roles, leading to different interests and thus different learning opportunities. In the context of children's learning using ICT in school, it can be proposed that the outcome is one of negativity for girls, in which there

would be a potentially negative impact on girls learning ICT related subjects. As Murphy and Ellwood conclude, factors external to the school environment lead children to align themselves differently in relation to schooling and specific subjects.

There is a broad variation in children's ICT facilities and access at home, relating to a variety of factors in addition to gender, for example socioeconomic (Rudd, 2002) or cultural issues. The effect of socio-economic factors has been shown by the General Household Survey (National Statistics, 2005a, 2005b) to impact on home Internet access, ranging in 2002 from 19% of households headed by an economically inactive person, to 70-83% of households in professional and managerial groups. This demonstrates the need to take account of the potential impact of socio-economic factors when evaluating informal access to computers and the Internet.

Most schools are conscious of a 'digital divide' amongst pupils and make an effort to create provision for this (DfES, 2004a; Howlett Sunley & Inman, 2003) perhaps through informal lunchtime or after school access. Figure 2.3 illustrates the growing provision of out of hours access to ICT facilities by pupils (DfES, 2004a).

Figure 2.3 ICT Facilities Available to Pupils Out of School Hours



Objective information is however rarely available to enable schools to evaluate the extent of home ICT access by their pupils. In addition, home access in itself can be inconsistent in quality, on occasion affecting children from the same household differently (Hayward, Alty, Pearson, & Martin, 2002). For example, even when home access to ICT is good, primary age children may not have precedence of use over older siblings and parents. Despite an apparent equality of physical access within the formal school situation, the research literature on pupils' informal use of ICT indicates gender divisions; this may have implications for growth of experience and confidence.

Over the last two decades, significant differences in access to computers have been found, favouring boys (Campbell, 1989; Chen, 1986; Colbourn & Light, 1987; Culley, 1988, 1998; Durndell, Glissov, & Siann, 1995; Millard, 1997).

Levin and Gordon (1989) found that the boys in their study were significantly more likely to have extra-curricular exposure to computers, and also were significantly more likely to know how to work a computer and to own a computer; 60% compared to 18%. Two other points are worthy of note here. Computer ownership contributed the most variance of the factors in an analysis of gender based differences in attitudes, rather than gender *per se*. In other words, girls who owned computers were more alike to boys who owned computers on the measures, than they were different. Secondly, in their study, Levin and Gordon presented evidence to suggest that boys, but not girls, held more stereotyped attitudes in respect of who is capable of using computers. The issue of stereotypes is expanded in a later section.

Robertson, Calder, Fung, Jones and O'Shea (1995a) found that whilst there was no significant difference between boys and girls (n=62) in terms of their overall access to computers, boys were ten times more likely to have sole access. This signifies the importance of achieving a clear demarcation of the degree of actual access by individuals. It is insufficient, for example, to simply ask if there is a computer at home or even if a computer is used at home. Perceived ownership, frequency of use, type of use, are all likely to be relevant issues in evaluating the degree of physical access.

In 2002, a survey '*Young People and ICT*' commissioned by the DfES (Hayward et al., 2002) found that 68% of households (N=1804) with a child of 5-6 years of age, and 81% of households with a child of 5-18 years of age, had a personal or laptop computer. The cited motives for buying a computer included child-related reasons, such as school or leisure needs. The percentage within this group increased in relation to the child's age, ranging from 78% of Key Stage 1 parents to 95% of Key Stage 4 and post-16s. Unfortunately, the data does not tell us the sex of the children so it is not possible to ascertain whether gender was a relevant variable in the purchase. However, the survey

does note that at all Key Stages, boys spent more time than girls using computers, even when playing with games was accounted for. This suggests that even when household access to a computer was available, boys were more active users than girls.

Another informal place for computer use is within schools, but outside of timetabled lessons, in the lunch break for example, or after school. Anecdotal evidence at the beginning of the research for this thesis suggested that boys were dominating these environments, but there was little research evidence then available.

From the literature then, a picture of usage is developing which shows a divergence in access to computers. This frequently benefits boys, apparently at a cost to girls, in terms of a relationship with computer confidence and attitudes (Chen, 1986; Colley, Gale, & Harris, 1994; Levin & Gordon, 1989).

Physical access is inherently implicated in gaining experience with ICT. The point that is not yet addressed, however, is the question of access at a discretely individual level: that is, choice, inclination, and motivation to access ICT, where this is physically available. The next section examines these aspects of psychological access.

2.5 Psychological Aspects of Access to ICT

The evidence presented in an earlier section established a continuing lack of presence by girls and women in educational and professional attainment in the field of ICT, a presence which has been described as ‘the pipeline shrinkage problem’ (Camp, 1997). What it does not show, however, are the possible origins of such observable differences. This section of the review begins to identify and examine the psychological elements that have been associated with gender differences in relation to computers. Two closely bound and important issues affording access to ICT at the level of the individual, attitudes and gender stereotyping, are considered. The gendered variation across types of use is discussed in subsection 2.6.

2.5.1 Attitudes and Computers

Attitudes are internal, psychological attributes, which are expressed by an evaluation of a specific stimulus in a positive or negative way. Thus they are not directly measurable but must be observed from the ways in which a person responds to that stimulus, either explicitly or by inference. Attitudinal objects can be abstract, concrete, individual or collective (Eagly & Chaiken, 1998).

A tripartite view of the nature of such responses has been put forward, classified as cognitive, affective and behavioural responses by, amongst others, Breckler (1984). Cognitive responses, whether thoughts or beliefs, are argued to result from the associations made between the attitudinal object and attributions ascribed to them (Fishbein & Ajzen, 1974). The affective element of attitudes consists of the association(s) made as a result of experience with an attitudinal object and the internal affective response elicited, for example, feelings, emotions or mood. Behavioural aspects of attitudes include both actual observable behaviour and intentions. All three responses can convey negative or positive evaluations of various degrees. Cognitive, affective and behavioural responses of individuals contribute towards the formation of attitudes and are expressed as classes in the tripartite model. However, this does not mean that all three classes have to be present in an attitude or that all three responses are needed in its formation (Eagly & Chaiken, 1998).

The tripartite model suggests a concept of attitudes in which they are not necessarily available for immediate measurement, but need rather to be drawn out, or inferred, by the use of indirect means. An association of a particular belief about, for example using a computer, and the type of person that uses a computer, could elicit a range of beliefs measurable by questionnaire; for example drawing out cognitions about a sense of self-efficacy, or stereotypes held. An affective association, perhaps a negative experience in

computer use, might elicit emotions and feelings such as anxiety or technophobia, measurable by physiological responses or verbally expressed and captured as data. Attitudes may also be inferred by observation of actual behaviour, or expressed intentions about behaviour.

Overall, however, the literature on gender and attitudes towards computers needs to be approached with a degree of caution. In an examination of methods used, Kaye (1992) found fourteen differing approaches towards the measurement of attitudes. Brosnan (1994) came to the conclusion that researchers had failed to reach a universal consensus about the relative strength of various dimensions, for example attitudes and experience, cited as impacting upon gender-related computer behaviour. Moreover, the range of methodological approaches, plus variation in how researchers define the constructs being examined, means that overall comparisons across studies are weakened (Kaye, 1992; Morse & Daiute, 1992). Typically, however, once exposure and prior experience are controlled for then gender differences are either much reduced or non-existent (Littleton & Hoyles, 2002).

Shashanni (1993) believed that the origins of a failure to participate economically and academically at higher levels within computer science are to be found in early educational experiences. In a study of 1,750 school children in America, she found a significant sex difference in attitudes towards computers. Girls were less interested, less confident; yet they held a belief in equality of competence. Furthermore, a strong relationship was discovered between students' computer attitudes and their perception of attitudes of significant others, for example parents, teachers and peers, toward computers. Shashanni argues that this reflects gender role socialization, with a significant relationship between perceived attitudes of significant others and students' attitudes towards computers. The study by Shashanni is perhaps indicative of the social

origins of the development of gender differences in attitudes towards computers. It highlights the influence of role models, and again brings to the fore a potential confusion between beliefs and actions, whereby the girls note that as a group that they are just as able, but then fail to bring this down to their own individual level.

The question of access to ICT has been investigated as a possible gendered variable in attitude outcomes. Robertson, Calder, Fung, Jones and O'Shea (1995a) investigated the effect of equal access to a computer upon confidence, by enabling a class of 12-year-old children to have individual possession of a Pocket Book palmtop computer during a school year. Measures of attitudes before the period of research revealed that girls were significantly less confident than the boys, believed they were less competent, held a less positive opinion about the value of computer use and indicated that they felt less likely to work with computers or learn about them. After the period during which the boys and girls had equal and unlimited access to the Pocket Book computers, the only significant gender difference to remain was for confidence, which nevertheless showed a reduced degree of difference compared to pre- test results. Personal access and experience obviated the effect of gender.

Contrasting results were obtained by Okebukola (1993) who examined gender influences upon students' perceived anxiety towards the use of computer and also interest in using computers. The boys and girls in this study were matched for equivalent home ownership of computers, enrolment in a computing class, experience, and socio-economic status. However, it was found that the girls were still higher in anxiety and lower in computer interest. Even when matched on key potential variables, including access, experience, and socio-economic status, an account emerged of a distinct gender difference in computer attitudes, which is effectively one of relative negativity for girls. The question arises here, whether the very literal and personal

possession of access in the case of the Pocket Book computers (Robertson et al., 1995a) was a significant factor in the differing outcomes. Millard (1997) for example noted that at home boys were more likely to have access to their own ICT and have a positive sense of their ability and confidence.

Access to computers and more latterly ICT has been the basis for many circular arguments, in which access is said to impact upon experience, attitudes, and confidence, and thus has an effect upon subsequent engagement with ICT. In other words, the exposure of an individual to ICT will produce positive effects at an individual level, and encourage further experience to be had, and so on. The flaw in this argument is that it does not take into account the situational context of access, both formal and informal. In the case of the latter, it can sensibly be assumed that access is voluntary. This cannot be assumed for the former, although it may indeed be the case.

It has been argued that the relationship of girls with negative attitudes towards computers is more directly attributable to one of prior experience rather than a direct one of gender, and that experience mediates this effect (Chen, 1986; Colley et al., 1994).

Colley, Gale and Harris (1994) found that when experience and gender stereotyping were taken account of, then computer attitudes between male and female undergraduates were not significantly different for computer anxiety, confidence and liking. They also found that whilst home experience impacted upon both sexes and was associated with a lowering of anxiety, confidence was greater for male students and liking greater for female students. Both male and female students were positively influenced in their attitudes by having a brother who used computers. However, having a father who used a computer was positive only for the male students; conversely, having a mother who used a computer was only positive for the female students. For the

male students, lower anxiety and higher confidence were experienced in the presence of a paternal role model; female students experienced a lessening of anxiety associated with the presence of the maternal role model. These findings indicate two areas of key relevance here. Firstly, the overall importance of experience in the informal setting of the home, and secondly, the differing aspects of that experience in terms of impact according to individual gender.

A relationship between gender, computer attitudes and computer experience has been demonstrated (Levin & Gordon, 1989; Shashanni, 1994a), with boys having greater experience and more positive attitudes. However, several studies have indicated that prior experience mediates the gender effects, removing or at least moderating them. The difficulty appears to be in voluntarily gaining that experience in the first place.

Arch and Cummins (1989) found that when there was a structured, that is compulsory, introduction to computers, the result was no statistically significant difference between male and female students in respect of use, attitudes, and self-confidence. However, in an unstructured, that is voluntary, introduction to computers, interesting and significant differences were found. Whilst the female students generally avoided the computers, showing negative attitudes and a lack of confidence, the male students would actively seek out the computers, find out how to use them and display positive attitudes. Female students with relatively higher prior experience in this group, compared to other female students, had higher levels of use, positive attitudes and more confidence, in relation to a similar comparison between males. In other words, prior experience had an influence upon the female students whereas, regardless of prior experience, male students had relatively more positive initial attitudes. This appears to function as a positive motivating factor encouraging active participation. The possibility of an influence originating from home experience needed to be clarified, however. The

results would have greater validity if the home experience of the students had been evaluated and included as a variable. In particular, it would have been of interest to see if there was a relationship between informal access and use, with attitudes and computer use at college level.

Confidence in computing skills has typically been found to be less for girls and women (Shashanni, 1997) even in situations where actual success has been measurably greater (Shashanni, 1994a, 1994b). Parental encouragement impacts positively on confidence, but boys receive more of such encouragement. Anxiety levels have also been found to be higher for girls and women, with the degree of anxiety increasing with age (King, Bond, & Blandford, 2002; Todman, 2002). A sense of self-efficacy with regard to computers is also shown by the literature to be one in which girls' and women's sense of individual capability is rated lower than boys' and men's, even when the objective evidence contradicts this (Collis, 1985; Makaris, 1993; Shashanni, 1993).

A study by Littleton, Ashman, Light, Artis, Roberts, and Oosterwegel (1999) emphasises the importance of context, in this case with respect to software design. They also argue for the importance of metaphor and imagery to be considered in the design process. Their research involved 10- and 11-year-old children interacting with a computerised version of moving a ring around a bent wire, in which a buzzer sounds in the event of the ring touching the wire. When the children were told that the task was a game, the girls touched the wire twice as often as the boys. However, when they were told that the task was a test to see if they would make a good technician or beautician, there was no gender difference in performance. The study suggests that the girls were more vulnerable to context than boys; whether in this instance the outcome is related to an influence of stereotyping upon performance, with girls perceiving the 'games' label negatively, is not clear.

Margolis, Fisher and Miller (2000) in the U.S.A. examined the processes at work which influence women computer science students to quickly lose faith in their ability and interest in the subject, leading them to change course. Margolis et al. point to a complexity of influences and set out the social and cultural expectations in the discipline that are discouraging women. In particular, they indicate the effect of male behaviour and male-focused interests being defined as the standard route towards success:

Success is linked to a stereotype based on a common male pattern of desires, interests, and attachments to computing. Hence it bolsters men's confidence and sense of belonging. This same culture does not assume (often accurately) that women conform; hence they enjoy no default expectation of success, and their interests and attachments to computing may be regarded as deviant from the norm, and less serious than those of the male students. This, combined with a vast array of gender socialization factors, chips away at women's sense of confidence and belonging in the field. Men who face difficulties with coursework do not struggle under the additional burden of the presumption that they are somehow inferior by virtue of their gender; nor do they have the pressure of feeling they are representative of their gender.

(The anatomy of interest: Women in undergraduate computer science, p.114)

In respect of the notion of one's own sense of effectiveness in achieving desired outcomes, self-efficacy (Bandura, 1986), girls and women have been shown to possess relatively lower levels with regard to ICT than boys and men (Comber, Colley, Hargreaves, & Dorn, 1997; Fletcher-Flinn & Suddendorf, 1996). Anxiety associated with ICT has also been found to be higher amongst girls and women than boys and men, with the former also demonstrating more negative attitudes. These differences have

been observed to increase with age across childhood (Brosnan, 1998b), alongside a decrease in use of home computers by girls (Comber et al., 1997). Anxiety and self-efficacy have been found to have an indirect relationship with experience in relation to computer performance (Brosnan, 1998a). Anxiety has been observed to impact upon computer-based learning. This has been argued to be attributable to the effect of anxiety negatively influencing levels of self-efficacy. Whilst anxiety reduces an individual's level of self-efficacy, experience is held to mediate this only if it leads to increased self-efficacy. Thus, the relationship between anxiety and computer performance is not direct, but moderated by self-efficacy.

2.5.2 Gender Stereotypes

Gender stereotypes have been defined as a collection of beliefs (Deaux & Kite, 1993) about the characteristics which together form a perception of something as masculine or feminine. These beliefs can be both interpretive and prescriptive; for example a belief that computers belong to the masculine domain and are therefore more appropriately used by boys and men. The use of stereotypes in daily life has been described as an inevitable process, providing the categorisation and conceptualisation of vast amounts of environmental data into succinct packages, enabling them to be handled in an efficient manner. For example, Allport (1954) in *The Nature of Prejudice* described how our daily judgments are guided by preformed categories, which are large classes and clusters drawn from prior experiences and influenced by social context, thus enabling a degree of predictability in an uncertain environment.

Gender stereotypes have been cited as being more prescriptive than other stereotypes, adding to their strength in social behaviours and control (Fiske & Stevens, 1993). In addition, gender stereotypes have been found to be used earlier in children's development than other stereotypes, race for instance (Mackie, Hamilton, Susskind, &

Rosselli, 1996) suggesting that the origins of gendered behaviours and attitudes start particularly early on in development.

Some gender stereotypes are directly measurable, such as beliefs about perceived height relating to the sex of individuals being observed, but others have to be inferred. This can be achieved by measures designed to capture beliefs, behaviours and attitudes. However, it has been noted that stereotypes and the beliefs supporting them are not necessarily available to an individual at a conscious level (Devine, 1989) and may only be discerned by measures able to tease these them out more subtly. For example, the projective draw-a-man/draw-a-person tests for children, originally developed as a test of intelligence (Goodenough, 1926), personality investigation (Machover, 1951), and later as a measure of emotional functioning (Harris, 1963), have in more recent times been utilised as potential indicators of attitudes. Drawings, as conceptualisations or stereotypes of groups of people, have been argued as providing a superior evaluation of attitudes than that of interviews or surveys. Barba (1990) in a study of 4,982 elementary children found this particularly so for children and adolescents. Brosnan (1999), found that at some point between five and eleven years old, children begin to stereotype computer use as a masculine activity. He also reports that in a 'draw-a-computer-user' test, girls were significantly more likely to draw males using computers than the boys were to draw females. Conversely, the previous study by Barba (1990) found that 56% of elementary students drew female users compared to 43% who drew male users. However, the study failed to ascertain the sex of the related participant in relation to their drawing response.

Not only are stereotypes a matter of outcome, but also one of process. The shift in recent years within social cognition has been away from consideration of the contents of

stereotypes, towards the actual process of stereotyping (Hamilton, Stroessner, & Driscoll, 1994).

Bem (1993) also proposed that the resultant gendered personality is both product and process; the individual selectively organises and allies themselves with information according to the way it is perceived as masculine or feminine. This can effectively limit the range of potential interactions to those which are deemed appropriate. The analysis by Bem suggests that girls at adolescence may be particularly sensitive to allying themselves with actions and attributes with which they identify their own sense of gender.

Bem examined the ways in which individuals construct a sense of gender, through a 'cultural lens' of perception. She argued that, in much the same way a 'cultural native' unconsciously acquires a sense of reality about their society whilst being oblivious to its dependence upon a consensual perception within that society, then a gendered sense of self is transferred from cultural meta-messages to the unconscious of the individual. Meta-messages contain information encoded in everyday cultural practices, communicating a cultural ideology; for example, an advertisement consistently depicting a consumer as a man in relation to a product conveys a meta-message about the gender appropriateness of that product. Such messages are argued to become internalised by the individual, producing a sense of identity which views and evaluates the surrounding environment in terms of what is considered consistent, or not, with that gendered identity.

The acquisition of stereotypes has been proposed to be a mutually reinforcing cycle (Bodenhausen, 1988) influencing the ways in which environmental information is perceived and subsequently processed. Thus it is argued that information is not given equal attention but will be selectively encoded to reinforce the stereotype provoked by

that information. Furthermore, evidence suggests that the stereotypes held will themselves have an influence upon how the information is perceived and measured (Biernat, Manis, & Nelson, 1991). However, this is not clear cut. It has also been suggested that information which is unusual, contradicting stereotypes held, will itself be more likely to be attended to (Rojahn & Pettigrew, 1992). An act which is considered more appropriate for one sex than another would be considered of greater strength when it is carried out by the opposite sex; thus it becomes relative to the stereotype held, rather than the reality of the actual act. An example of this would be a girl who chose to be assertive with her abilities and knowledge in an ICT class. It could be argued that gender stereotyping would make her action more salient and more likely to be attended to by her peers, rather than her exceptional ability across the class as a whole. These factors perhaps have implications for the usefulness of positive women role models in ICT.

The processes outlined above are suggestive of the causes of apparent inequities of participation within domains such as computing. Having acquired a cultural and social concept of gender-appropriate interests and behaviours, it can be argued that these will influence subsequent attendance to information in the social environment. Whilst the person might be able to demonstrate an apparent attitude which supports 'correct' notions of equal participation and ability, in practice they may ally themselves with their stereotyped perceptions of gender-appropriate behaviour. This is further evidenced by a paradox described by Collis (1985), in which girls demonstrated a belief that as a group they were generally not less capable than boys at computing; however, they personally were and so presented a contradiction of beliefs, namely 'We can, I can't'.

The relative absence of women entering higher education in the field of computers has been a concern for at least the last two decades. Stereotyping has been considered a

major factor for this (Archer & Macrae, 1991; Durndell, Glissov, & Siann, 1990), alongside a lack of role models and a sense of intimidation by girls and women in ICT environments (Spertus, 1991). Computers and their culture are perceived as dominated by masculine associations (Kiesler, Sproull, & Eccles, 1985; Turkle, 1984). By 2002, studies were still showing that gender stereotypes in computers were prevalent (Beyer, Rynes, Chavez, Hay, & Perrault, 2002; Colley & Comber, 2003.)

Differences potentially contributing towards a continuation of the gender stereotyping of computers have been attributed to interest, types of use, and role models (Arenz & Lee, 1990). It is difficult to differentiate between cause and effect - these various elements are conceivably due to prior beliefs - but they also find continuing support and reinforcement from the environment. The stereotyping of computers as a boys' and men's domain, for example, has found support in many studies investigating the relationship of computer use with gender (Preston, 1995).

Individuals' developmental stage in relation to stereotypes and ICT has also been found of relevance. Gender stereotyping has been observed at a young age. Tan (1985) found that 4-year-old children with no computer exposure in a pre-school environment demonstrated gender stereotyping, with the children choosing computer activities as more appropriate for boys more than for girls. However, amongst children with computer exposure this difference was absent, suggesting that early familiarisation in this context may be an important element in reducing the impact of gender stereotyping. Newman, Cooper and Ruble (1995) found that girls aged 5-9, with gender-constancy and rich gender stereotypes, were less positive towards computer use than others.

Williams and Ogletree (1992) examined sex differences in computer competence and interest in preschool children, in relation to gender role concepts. Whilst boys viewed the computer as male orientated, girls viewed it as female oriented. Williams

and Ogletree proposed that preschool-age females have not acquired the stereotype of the computer as 'masculine'.

Significant age differences in computing enjoyment have been found, and also age and gender differences in confidence (Comber, Colley, Hargreaves, & Dorn, 1997). Whilst this may be attributable to the growing influence of gender stereotypes during adolescence (Lage, 1991; Measor, 1984) it could also be due to a cohort affect, with the younger age groups experiencing a greater and more positive exposure to information technology.

Lage (1991) investigated social representations of technical interest attributable to gender in primary and junior-high school pupils. She found at primary level the perception of involvement in technical interests was one of gender equality, and a girl 'computer enthusiast' was considered a very attractive person. However, at junior-high level this perception of equality had disappeared and a girl 'computer enthusiast' was judged negatively. The girls perceived that too great an interest in computers reflects loneliness and problems with sexual identity. Lage proposes that the 'normative model of feminine identity' can partially explain the decline in computer interest observable in secondary-school.

These studies highlight key areas for examination. Firstly, a cohort effect may mean that the younger groups have experienced a more positive exposure to information technology, which may carry through to later stages. A longitudinal study would be required to elucidate this factor. Secondly, at very young ages, children do not appear to have acquired stereotyped notions regarding the gender of computers. However, in the older age groups these do appear; in particular, boys see the computer as male and as being their 'territory' (Millard, 1997). It would appear that girls do not explicitly accept this definition, yet their actions contradict this.

Another feature that emerges from the literature is the strength of gender stereotypes held in relation to individuals' sex. Boys appear to have far stronger attachment to sex-stereotyped views about computer use than girls (Durndell et al., 1995). It seems probable that boys are more vulnerable to sex-role stereotypes than girls (Durndell et al., 1995; Fletcher-Flinn & Suddendorf, 1996; Levin & Gordon, 1989; Shashanni, 1993). Durndell, Glissov and Siann (1995) noted that older boys were more likely to endorse sex-stereotyped views than their female contemporaries. More interestingly, it has been suggested that even when girls do have confidence in their computing abilities, they may simply choose not to participate at higher levels; an attitude of 'I can, but I don't want to' (Lightbody & Durndell, 1993). Further support for this argument is found in the research by Shashaani (1993), who described how the girls in her study rejected a stereotyped account of computing as a male domain, yet still the girls were not willing participants. The boys, however, did demonstrate a stereotyped perception of computing as a male domain.

Crawford and Chaffin (1997) highlight similar findings from the literature, in which boys, in comparison to girls, were found to hold more strongly the belief of the appropriateness of mathematics as a masculine domain. This, argue Crawford and Chaffin, suggests that gender-related influences are not just operating at the level of the individual, but also at the interactional and societal levels; the imbalance in strength of belief between the sexes could be indicative of an impact of boys' behaviour affecting girls' diminishing interest in the field. Or, equally it could be argued that girls' withdrawal is one of choice rather than coercion. If girls' association of a domain, such as mathematics, is associated with what they perceive as negatively stereotyped attributes, then they may elect to individually withdraw despite a belief in the universal appropriateness of the domain for both sexes. Here, however, the proliferation of

computer games and their association with masculine attributes appears to have superseded the role of mathematics.

Gender stereotypes are often reinforced in computer video games, with women either being ignored, sexualised, or in positions lacking authority or power. It can be argued that the strong association of computers with these types of games is potentially discouraging for girls on two levels. Firstly, the informal routes to computing confidence and interest potentially promoted by games use may not be so available to girls. Secondly, gender stereotyping of computers as a male domain could be reinforced by the association with these games, which are typically concerned with masculine themes of action, aggression, sport and adventure (Griffiths, 1993; Kiesler, Sproull, & Eccles, 1985).

2.6 Gender and Types of ICT Use

Looking next to the directly observable behaviours in relation to gender and ICT, the literature indicates that there are important gender differences to be found in the types of use of information technology, for example, girls showing a more pragmatic interest in computers as tools, rather than for any intrinsic value (Hennessy, 1999; Siann et al., 1990). This aspect is reflected in the lack of gender differences for certain types of use, for example word processing, which fail to carry through to other levels of usage, such as programming.

Robertson, Calder, Fung, Jones and O'Shea (1995b) also found that when patterns of usage were examined for types of computing knowledge certain gender differences emerged. Content-free applications (databases, desk-top publishing, email, graphics, logo programming, spreadsheets, word-processing) showed no significant difference. The means for girls were lower for these applications however, except for word processing where the girls' means were higher than for boys. Conversely, on

examination, significant gender differences were demonstrated for knowledge of adventure games, games, computer control, CD-ROMs, computer simulations and drawing. This, it can be proposed, is an indicator of the gendered routes to computing activity between the sexes.

Further evidence suggests that the impact of gendered software also influences preference of use between boys and girls. Joiner (1998) found that presenting a computer-based problem to 11-year-old children with a differing interface, *Pirates*, *Princesses*, *Honeybears*, and *Blocksworld*, produced gendered preferences. Overall, both boys and girls preferred *Pirates*. However, the boys were significantly more likely to prefer *Pirates* compared to the girls, and the girls were significantly more likely to prefer *Princesses* than the boys. Whilst the girls showed no significant preference for *Honeybears*, *Pirates* or *Princesses*, the boys did significantly prefer *Pirates* above *Princesses*. Joiner concludes that the findings support previous literature that argues that boys prefer gender-appropriate toys more than girls.

Not only is the type of computer use apparently gender-related (Culley, 1988; Martin, 1991), voluntary use is less amongst girls and women (Robertson et al., 1995b). The evidence points towards a divergence in attitudes and perceptions in relation to information technology.

The report 'Young People and ICT 2002' (Hayward et al., 2002) found that of children with a computer in the household, girls were more likely to do school work on a computer at home than the boys. Across all Key Stages it was found that boys consistently spent longer periods of time playing games than girls, typically around twice as long.

It has been argued that the gendering of computer games as 'toys for boys', and their subsequent lack of appeal to girls, could be related to girls' subsequent inclination to

apparently approach computers less confidently or without much enthusiasm (Holloway, Valentine, & Bingham, 2000; Lockheed, 1985). The relevance of this, in terms of experience, is discussed in a later section.

Frenkel (1990) described how 'when women do not see computers as efficient tools they lose interest'. This suggests a differing intrinsic valuing of ICT applications, of use, and therefore has implications for types and possibly frequency of experience between the sexes.

Millard (1997) also indicates gender disparity in use. In her research into gender-related differences in access amongst Year 7 (11/12 years old) and Year 9 (13/14 years old) school pupils at four English schools, she found that there was relatively little difference in overall access to home computers. However, boys had greater access to games machines, 58% compared to 50%, and lesser access to a PC, 33% compared to 39%. This, she suggests, may provide a context in which the use of computers for girls is more directed towards homework-related tasks, with 37% of girls using them for this purpose, compared to 29% of boys. In particular, Millard notes that the boys were far more likely to express time spent on the computer as a 'lot', 44% compared to 27%. Millard found in a follow-up interview that this was attributable to the boys playing games for extensive periods of time.

One of the critical factors here is the question of 'ownership'. In Millard's study, over 56% of boys reported that the computer was in their own room, compared to 39% of girls, which she relates to the boys' greater level of self-confidence. This is highlighted also by the finding that 11% of girls at suburban schools and 30% of girls at inner city schools only had access to a computer that was in a sibling's room. Conversely, no boys' access was, which is suggestive of the gendered nature of computers and ownership, especially games machines. Millard argues, however, from

her analysis of the data, that when girls do have free access to computers they adapt them to their own use and interests. This finding points to a dichotomy of interaction style between the sexes in relation to computers.

Turkle (1984) also explored differences in interaction style. She described 'soft mastery' and 'hard mastery' approaches to computer programming, in which the former is associated with a flexible interactive, concrete conceptualisation of the task, and the latter with a pre-determined, structured, abstract approach. She highlighted a relationship between styles and gender in which females are more likely to utilise a 'soft mastery' approach, and males 'hard mastery'. This, Turkle argued, is a not unsurprising outcome of our culture, in which boys are encouraged to display behaviours in which they are assertive and enforce their will over situations. Conversely, girls are said to be required to develop behaviours which place the emphasis upon negotiation and flexibility within situations.

Boys' observable domination of computing facilities and group interactions with computers (Barbieri & Light, 1992; Durndell et al., 1995; Keough, Barnes, Joiner, & Littleton, 2000; Millard, 1997) adds support to Turkle's argument. In both educational and social contexts, boys have been reported as dominating the ICT situation, commanding more teacher attention (Culley, 1998) and achieving greater gains in experience.

If a cultural artefact such as the computer becomes 'gendered' then the use of that item by the opposite gender can be uncomfortable and unattractive to them. If we consider identity to be a concept which is always 'in progress', actively constructed and construed, then the use of cultural artefacts is, it can be argued, both part of the process and also the outcome. In other words, whilst such artefacts can be actively used in the formation of a self-concept of identity, they can also become objects considered to be

‘not part’ of that identity and therefore not of interest or importance to that individual. The question is, will the Internet be similarly implicated? This issue may well be illuminated by consideration of a developmental influence upon the formation of gendered attitudes towards computers and the Internet, together with an examination of social interactions and influences within real, every-day contexts.

Consideration has been given in the previous sections to the issues of access, both physical and psychological such as attitudes and gender stereotyping, and their impact on the relationship of gender to computers. In the next section, the focus moves towards the overt expression of psychological access by examination of the uses of ICT, particularly the Internet. Actual behaviour, it could be argued, is indicative of the nature and degree of psychological access.

2.7 Gender and the Internet

At the beginning of the review of the literature for this thesis, prior to commencement of the exploratory study reported in Chapter 4, it was necessary to examine the evidence for variables impacting upon gender and attitudes in relation to computers, rather than ICT such as the Internet. This was because of the relative small body of specific research at that time. However, there were some early findings of interest and this section looks at these, followed by up to date research of relevance.

The effect of prior computer experience and attitudes upon subsequent use of the Internet was reported in the HomeNet study (Kraut, Scherlis, Mukhopadhyay, & Manning, 1996), which involved 48 families who were provided with computers, online access, training, and technical support. The study found that prior experience with computers was the most predictive element of Internet use, with age and gender also being strong predictors; male teenagers were the heaviest users.

Research on gender and attitudes towards the Internet suggests that there is a relationship between this aspect and computers *per se*. Morahan-Martin (1998) for example, reported that women and girls were using the Internet less than, and in ways that differed from, men and boys. She proposed that negative attitudes towards computers may in turn shift towards Internet attitudes and use, with Internet culture itself being hostile and aversive towards girls and women, as exemplified in online communication research.

Looking next at evidence relating to Internet use amongst school children, OECD (2005) reported a series of findings from the Programme for International Student Assessment (PISA) 2000 database, which carries out an internationally standardised assessment of 15-year-olds across 43 participating countries. The results suggest that there is a persisting gender difference in relation to ICT. Table 2.5 shows the OECD average percentage of 15-year-olds' use of computers and the Internet at school, with boys' frequency of use consistently exceeding that of the girls.

Table 2.5 Students' Frequency of Use of Computers and the Internet at School

Use of computers at school				Use of the Internet at school			
Once a month or more		A few times per year or never or hardly ever		Once a month or more		A few times per year or never or hardly ever	
Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
59%	64%	41%	36%	40%	48%	60%	52%

With regard to the actual type of use, Table 2.6 illustrates the OECD report of PISA data, showing that across several types of ICT use boys again outnumber girls in the extent of their use. The widest gap appears for programming, and the narrowest for use of computers to learn school material. This is suggestive that the type of use has

particular relevance to gender and interactions with ICT. For both sexes, use of the Internet proved the most popular.

Table 2.6 Students’ Type and Frequency of Use of ICT by Gender

Frequency of Use							
Once a month a month or more		Less than once a month or never		Once a month a month or more		Less than once a month or never	
Use of the Internet				Use of electronic communication			
Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
69%	77%	31%	23%	60%	65%	40%	35%
Use of computers to help learn school material				Use of programming			
Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
61%	62%	39%	38%	31%	47%	69%	53%

A further analysis by OECD of the types of use, presented in Table 2.7, shows that games use produces the greatest gender differential, 25%, with boys predominating. Word processing and use of educational software showed the least differential, 2%, although again boys’ use was the greater. There is an apparent gender difference in the actual types of ICT use between the sexes; this could be an important factor in indicating aspects of psychological access. Since the questions asked of the PISA participants were not bound to use in schools, for example, ‘How often do you use the Internet?’, this indicates that data from informal contexts, such as at home, was also being captured and greater weight can be given to the findings as providing an overall picture of gender and ICT use.

Table 2.7 Students’ further Use of ICT by Type and Gender

Frequency of Use			
Once a month or more		Less than once a month or never	
Use of games			
Girls	Boys	Girls	Boys
62%	87%	37%	13%
Use of word processing			
Girls	Boys	Girls	Boys
78%	80%	22%	20%
Use of spreadsheets			
Girls	Boys	Girls	Boys
43%	54%	57%	46%
Use of drawing, painting or graphics software			
Girls	Boys	Girls	Boys
49%	60%	51%	40%
Use of educational software			
Girls	Boys	Girls	Boys
42%	44%	58%	56%

In summary, the PISA data shows that boys’ use of computers and the Internet in school was greater than that of girls; use of the Internet was the most popular activity involving a computer for both sexes; and that the type of use of ICT was particularly gendered. Boys dominated the areas that could be labelled as ‘fun’ domains, such as games and drawing, painting or graphics software; there was a notably narrowed difference for frequency of use for those areas, which it could be argued, reflect pragmatic use, such as word-processing and educational software.

Weiser (2000) in a study of Internet use by undergraduates in the USA found gendered preferences for types of use, with women showing a preference for communicative and educational usage and men preferring entertainment and leisure related usage.

Jackson, Ervin, Gardner and Schmitt (2001) proposed and tested a general model of Internet use, in which gender and other factors held responsible for differences in Internet use were explored. Their survey of 630 undergraduates investigated gender, types of use, potential affective and cognitive mediators of use and affective and cognitive outcomes. E-mail use was found to be greater amongst the women and web use greater amongst the men. However, whereas the choice of use was gendered, overall use of the Internet was not found to be so; when the measures of use were combined then gender differences disappeared. Women participants in the study reported greater levels of computer anxiety and a reduced sense of computer self-efficacy compared to the men. Less favourable and less stereotypic computer attitudes were also reported for the women.

The study by Jackson et al., (2001) was particularly interested in the motivational, affective and cognitive antecedents of use of the Internet. They predicted that when these and other factors relating to self-efficacy and technology familiarity were controlled for, then gender differences in outcomes would disappear. In other words, women and men who are alike for these variables would not be different in their Internet use. Computer self-efficacy, loneliness and depression, were found to account for gender differences, but only in part; gender was still identified as having a direct effect on use. The authors put forward proposals to account for this. They suggest that perhaps one or more gender-related factors, not measured in their study, could explain the finding. Familiarity with technology was not measured directly for example, or motivations for communication. What might be more usefully explored further, however, are potential links between gender, intrinsic factors underlying motivation to use or inhibitions on use, and notions of identity and stereotyping unique to the individual participants. The Jackson et al., (2001) model presents a useful insight into

some of the underlying psychology of Internet use and potential factors responsible for gender differences here, but recognises that it is only presents a partial picture.

Looking next at informal contexts, Facer, Furlong, Furlong and Sutherland (2003) carried out an in-depth research project from 1998 to October 2000 in which they investigated the use of computers in the home, negotiation by parents and children of access to and use of the computer, and the role played by the computer in families' everyday lives. The research was carried out in three phases, with 855 young people participating in a questionnaire on home and computer use, 18 case studies over an 18-month period involving interviews and observations, and group interviews in a school context with young people who self-reported themselves on the questionnaires as low users of computers.

The authors note that the domination of computer access observed by researchers in schools was also a factor within families, with parents having to monitor access to ensure that their sons did not effectively exclude fair access. Access, in terms of the presence of a computer, is not demonstrable proof of actual access or use. As Facer et al. argue, access can be impacted by negotiations involving parents and siblings to do with issues of time on the computer and the type of activities.

Gender was found to be a major influence by Facer et al. on how children come to use ICT in their lives. Children are presented as clearly understanding the meanings attached to such technology by society, manufacturers, and by individual families; but the ways in which they respond in the use of computer products and practices to construct their own gendered identity are argued to be complex and wide-ranging.

Facer et al. considered the role the computer plays in children's construction of identity, arguing that computer-based technologies offer a flexible and wide expression of possible identity, rather than a notion of fixed meanings. The computer is presented

as a powerful and complex cultural symbol, with a vast range of meanings to different individuals. However, the public gendering of computers as a medium for boys, rather than for girls, is attributed to an association with games playing. Despite this, Facer et al. argue that the actual relationship between gender and computer use is far more complex than might be apparent, with actual differences in use presenting with great subtlety. For example, in their case studies they cite a girl and a boy as story writers, yet the manner in which they expressed themselves as writers was gendered in style and content. Facer et al. concluded that although the computer and its differing uses were involved with individual children's gender projects, with some boys for example expressing masculinity through stereotypical aggressive game play, most children's use in terms of gender projects was far more complicated.

Colley and Comber (2003) looked at possible changes in computer experience and attitudes among 11-12 year old and 15-16 year old students, following a period of time in which exposure to ICT through the school curriculum and at home had become more extensive. They found that although there had been some change since the early 1990s, the increase in ICT exposure had not resulted in a closed gender gap, although there was some evidence for a narrowing of the gap. Boys still had a greater liking for computers, were more frequent computer users, and had greater self-confidence in computer use, than girls. It was also noted that older girls still held less positive attitudes, a finding commensurate with previous studies. Colley et al. suggest that the cultural pressures of stereotyping may be an influence here, rather than perhaps being attributable to a cohort effect.

A research project carried on behalf of the DfES in 2004 (Valentine, Marsh, & Pattie, 2005) investigated the links between children's educational uses of ICT at home and their performance and attainment at school. Girls were found to be higher users of

computers for school work compared to boys. Boys were found, however, to be more prolific leisure users of ICT, with access to more items of hardware and to be greater users of computers outside of lesson time than girls. Valentine et al. point to a gendered pattern of ICT use, with girls using it for educational purposes and boys for fun. They argue that this has potentially negative implications for a gender educational gap whereby high levels of leisure use of ICT were found to correlate negatively with educational attainment.

The research by Valentine et al. also found that boys in Years 6, 9 and 11 had greater access to computers and were more intensive users. Once again, boys were found to be more frequent users of the computer for games. Another gender dimension found that the boys were significantly more likely to use a computer at lunchtime, after school or at a homework club. The type of leisure use was also gendered, with more boys having their own webpage, playing 'fun computer games', and girls reported as being more likely to use 'educational games'. Boys were also found to hold opinions which suggested a greater sense of self-efficacy in their use of computers.

Valentine et al. argue that schools need to address reasons why girls were less frequent users of ICT out of lesson time at school, suggesting that girls find computer clubs more intimidating, are less confident, and that they perceive their peers as regarding computer clubs as masculine and also potentially spoiling their social identities.

Whilst Valentine et al. are primarily concerned with a negative impact upon boys' attainment relating to their type of computer use in leisure time, they do not address the issue of longer term engagement and retention of interest in pursuing ICT-related attainment.

The Pew Internet & American Life Survey: How Women and Men Use the Internet (Fallows, 2005) presents the latest evidence on Internet use suggestive of gender differences in the voluntary take-up and usage of the Internet in the U.S.A. domestic context. In 1995, 58% of American adults going online were men and in 2000 men were still significantly more likely to be Internet users. By 2005, the survey found that 66% of women and 68% of men were Internet users, effectively closing the gap. The findings also point to a shift in Internet demographics, with 86% of younger women compared to 80% of their male contemporaries in the age group 18-29 going online. However, far fewer older women go online, compared to men; in the over 65 years of age group 21% of women compared to 80% of men went online. Men were found to be far more intensive users, going online more frequently, more likely to have high-speed connections at home, and more diversity in online activities. The scope of the survey shows a divergence in the type of usage.

With regard to the type of online use, women had greater enthusiasm for communication, sending and receiving more email for example, whereas men were more interested in recreational applications. Aside from games *per se*, men were found to be more likely to pursue hobbies online, for example taking part in sports fantasy leagues and downloading music and video files. The perceived entertainment value of the Internet was reported as being higher for the men in the survey.

These findings give weight to a cohort effect, with younger women more likely to engage with online use than their seniors, and are also suggestive of a gendered divergence in the applications of use. Whether the growing equilibrium of domestic Internet access across the sexes in the younger cohorts will be reflected in measures of ICT confidence, experience, academic achievement and professional lives remains to be seen. The apparently gendered differences in emerging types of Internet usage may,

however, say more about voluntary choices; perhaps reflecting and identifying gaps in educational agendas.

2.8 Continuing Policy Relevance

The issues raised by the literature on gender and computers are not only still relevant as our society moves rapidly into an era of interactive and dynamic media, but also even more pertinent as the potential consequences of such inequities impact across a wider range of situations.

The aim of the Government to produce an information and communication network, intra and inter schools (DfEE, 1997a) promised changes to our perception of the media through which learning can be achieved. It also added a whole new dimension to the processes of learning, which it could be argued is analogous to the differences between oral and written literacy - both historically and between some contemporary societies.

At the e-summit of November 2002, the Prime Minister announced that all schools would have a broadband connection by 2006. The potential of broadband connectivity to offer change, improvement and access to a vast array of media rich resources, is already beginning to reach schools. In August 2002, previous targets set for schools' broadband connectivity were exceeded, with 22.3% of schools (72% of secondaries and 12% of primaries) in England having broadband access of at least 2Mbps. Broadband connectivity to schools is increasing at a fast pace, with secondary schools leading the way. What then, will the impact be in the classroom?

The present UK government not only has a continuing commitment to ICT in education, but an expanding agenda (DfES, 2005a), which shifts the emphasis away from crude provision of infrastructure, hardware and content, towards the development of new pedagogies and a focus upon personalisation and individual facilitation. This

suggests that the question of psychological affordances of ICT, as offered and received at a distinctly individual level, is moving towards the fore.

One initiative designed to address the gender digital divide is the Computer Clubs for Girls (Computer Clubs for Girls (CC4G), 2002). This was initially undertaken in 2002 as a feasibility study, following which The South East England Development Agency and E-skills UK undertook further development of the project. E-skills is a not-for-profit organisation, recognised by UK government as the 'collective voice' of employers on IT and telecoms skills issues.

Government and Industry jointly funded the initial study. The initiative for the CC4G arose from two key factors that have particular relevance for the geographic region in which they were trialled. Firstly the high proportion of IT industries located in this area, and secondly the lack of labour with the skills required. Estimates were of a shortfall of 250,000 IT professionals in the South East by 2006. The solution was seen to be the encouragement of women into the IT workforce. By targeting girls, perceived as at a critical age, to view IT in a positive way with possible relevance to their own career aspirations and challenging negative stereotypes and perceptions, CC4G aimed to redress present inequalities and solve the labour problem. Without such action it was claimed that IT industries would simply relocate abroad.

The CC4G scheme is based upon an hour a week outside of school time in which volunteers facilitate access to ICT for girls age 10-14 years. Proposed motivating factors, for example developing a magazine's front page with the participating girl's image, whereby images would then be submitted to a real modelling agency and the 'winner' would have their image reproduced on a real magazine cover, were implemented into the club design. Other incentives represented a cross-section of

researched girls 'wish lists' such as David Beckham visiting schools or pop groups playing at a birthday party.

The point of this style of approach was to encourage the 'cool' set within school settings to get interested in participating, breaking the 'nerdish' connotations and challenging stereotypes. By undertaking motivating tasks, ICT skills such as programming, website design, creating databases, and using the Macromedia Flash authoring tool, would hopefully be achieved and continued interest maintained.

The CC4G trials have been seen as successful, with 66% of CC4G club members saying that they are more likely to consider a career in technology (e-skills, 2005). A programme to extend the scheme nationally began in Autumn 2005. Whilst the CC4G scheme attempts to directly respond to an economic problem of sufficient ICT workers, overall success outcomes remain to be seen. It could be argued that the scheme merely challenges one stereotype by reinforcing others.

An alternative approach for tackling the inequity of engagement apparent between the sexes with ICT has been put forward by Littleton and Hoyles (2002). They contend that the type of computer use that is required in schools may only serve to compound girls' withdrawal from participation, and that there is a very real danger that existing social relations could be reproduced and may even be further exaggerated. They suggest that existing styles of ICT use in schools disadvantage girls. Indeed, the use of ICT in schools is argued to be fundamentally at odds with computer use in the home.

In proposing a challenge to the existing school paradigm of computer use, Littleton and Hoyles put forward two key areas for attention that need to be concentrated upon if equality of access and performance are to be redressed. Firstly, epistemological pluralism, in which a diversity of learning interactions can be facilitated by ICT, rather than educational experience being dictated by a restricted notion of appropriate

computer use, is now a realistic objective. Secondly, the embedding of technology into the curriculum; here, the integration of ICT into education as a tool that is available for use as and when appropriate, deflects the danger of ICT existing as an isolated 'add-on' facility with more in common perhaps with masculine top-down mastery (Turkle, 1995) than a ubiquitous facilitator of learning. Specifically, the separation of computers from the curriculum and context of the class into isolated situations, such as dedicated computer lab rooms, risks the continued promotion of a masculine culture which has historically become associated with ICT.

Littleton and Hoyles emphasise the importance of children's developing ability to use ICT as a situation demands, with informed decision-making skills about the extent and limitations of ICT use being applied. The use of the WWW in education is becoming particularly salient here, and Littleton and Hoyles argue that new skills, such as sifting and interpreting information will be required.

The need for curriculum change, reform, can be seen as key; not 'remedial' actions such as CC4G (2002) or segregation of children by sex. Indeed Littleton and Hoyles state:

So while the strategy of segregating boys and girls for computer-based work holds the superficial appeal of side-stepping potential male domination over resources both physical and human, it is not a long-term solution and could result in attention being diverted away from the fundamental issue of curriculum reform.

(2002, p.11)

Current educational practice with respect to ICT has yet to succeed in embracing new ways of learning (Pittard, 2004). ICT is still often a fragmented addition and remains a condiment, rather than a major staple embedded into the curriculum.

2.9 Summary and Conclusions

The objective of this review has been to examine the literature providing the background to three areas relating to gender and use of the Internet in education: gender-related attitudes towards Information Technology; the effects of gender stereotyping; and the expansion of educational computing into the era of the Internet. It is the area of intersection for these domains that forms the focus of the research carried out for this thesis.

This review of the literature on gender, attitudes and ICT, has suggested inequities of participation, physically and psychologically. From the literature, it can be concluded that provision of equal physical access to information technology in education is only a partial solution.

Fundamentally, girls are not voluntarily accessing the full range of information technology resources and maximising their potential. The suggestion is that girls are disadvantaged in achieving psychological access to computers, as demonstrated through negative attitudes and a lack of confidence. Yet, when they are obliged to participate, they prove equally competent. Furthermore, perceptions about appropriate use of information technology appear to diverge between the sexes. One possible origin of this may lie in the informal routes to computer literacy, for example through game playing and the predominance of male-orientated software. The potential role of the Internet as a psychological tool, analogous to that of the written word, raises the question of whether the concept termed in this thesis *psychological access* will be equitable between the sexes. Furthermore, will the nature of the Internet - relational and more intuitive than previous forms of information technology - promote an equality of participation, albeit perhaps being utilised for different purposes between the sexes?

The impact of the medium, the Internet, in a new age of technology, provides the basis of the research presented for this thesis. The focus is upon the use of the Internet in education in relation to issues of gender and attitudes amongst adolescent children. Voluntary informal access in home and school contexts is examined, together with their potential association with psychological access at an individual level.

It can be argued that the Internet is the contemporary equivalent to the emergence of the written word, with all the concurrent implications associated with the rise of a new psychological tool. Whilst the potential for positive gains, educationally and socially, are immense, there remains a real danger that previous inequities of opportunity will be reproduced. Physical access to ICT is in theory now more equitable between the sexes than ever before. Yet, previous inequities observed in relation to gender, attitudes and computers have failed to vanish after some three decades of exposure and pedagogical experience.

Stereotypes and attitudes have been implicated in the inequity of psychological access to computers. Whilst formal mandatory policies may ensure initial participation, they fail to guarantee continued interest and motivation at an individual level. Experience has been cited as a key factor in establishing gender parity and challenging stereotypes and attitudes. Given the potential weight and importance of experience gained outside of formal contexts, examination of informal contexts is crucial in establishing the degree of individuals' psychological access, as expressed via voluntary ICT use, attitudes, ongoing relevance and motivation to engage. Consideration of both informal and formal contexts and their relationship to psychological access is therefore necessary to gain a clearer picture.

The relevance of gender inequities found in relation to computers now has far wider implications. As the spread of the Internet into our working and social environments

grows, the potential contamination of girls' and women's perception of ICT by an association with computers *per se*, has even greater implications than previously, particularly with regard to full professional participation in our society.

The literature on gender and computers has suggested that there are gender differences in attitudes, but also that experience can help mediate the factors associated here. Inequities in physical provision and exposure have at first sight been addressed by policy-related change. However, whilst differences in physical access might be seen as a *prima facie* cause of gender variation in attitudes and perceptions of information technology, it could also be argued that the perspective of psychological access, addressed in this thesis, challenges such a simplistic analysis. Provision may be made, yet without psychological access, gender inequities will continue to be observed.

This thesis therefore explores and defines the components which it proposes contribute towards a psychological construct of *Psychological Access to the Internet* (PAttI). It also develops a measure of PAttI. The development and measurement of the construct is grounded in the context of adolescent children, in both formal and informal environments, and attempts to answer the question:

Will the inequity of psychological access demonstrated in a substantial body of research into gender differences in attitudes and computers in education, be repeated in relation to adolescents' use of the Internet?

CHAPTER THREE

3 DESIGN AND METHODOLOGY

3.1 Introduction

The review of the literature highlighted several key variables relating to gender and computers. These encompassed gender stereotypes and a range of attributes falling under the collective label of attitudes. The impact of age and context of use was implicated in gender differences and the question of an effect of experience was raised. Access as a determinant in gender equity was examined, not only in the degree and range of physical access, but also as access in the sense of affordances for individuals. This was identified and proposed as a matter of psychological access. Whilst explanatory notions to account for gender inequities in respect of computers have been put forward, the arrival of the Internet presents a new phenomenon demanding consideration of new theories and thus justifying an exploratory approach.

The research for this thesis was therefore designed to identify, explore and measure the factors relating to the psychological construct entitled by this research, Psychological Access to the Internet (PAttI).

Individuals' psychological access, an abstract construct, is proposed to have a relationship with voluntary participation with ICT, impacting outcomes in terms of intent, behaviour, experience, and equity of educational and professional participation.

In order to define and measure a conceptualisation of the psychological construct PAttI, it was necessary to identify key contributing components of the construct alongside the development of an appropriate measure. The research for this thesis therefore comprised several phases of exploration, development and refinement, carried out across exploratory, investigative and interview studies, culminating in a major survey study.

This chapter presents the overall rationale, design and methodologies involved for identification of components of the construct of PAttI and its measurement. Subsequent chapters detail the methods in practice, setting out their application in the course of the research for a conceptualisation and measurement of PAttI.

3.2 Overall Design of the Study (Conceptual Framework)

This thesis proposes a psychological construct of PAttI, marked by latent factors such as attitudes and overt behaviours, for instance the degree of facility with which an individual will voluntarily engage with Internet use when given the opportunity.

The importance of such engagement for the individual and for society as a whole has been indicated in the previous chapter, highlighted by gender differences in ICT across various factors and by their apparent relationship with differential educational and professional outcomes.

3.2.1 ‘Grounded Theory’

The prime methodological model influencing the research design was based upon grounded theory (Glaser & Strauss, 1967). Theory is drawn from data and then recursively compared back against data, by identifying key emerging categories and sub-categories. During this process, theoretical ideas, propositions, are developed, perhaps suggesting a main concept or finding patterns, links and relationships between categories and subcategories. In effect, it is the data itself which creates the pattern, and from this emerges likely candidates for a theory underlying the data.

In order to give greatest validity to a conceptualisation of PAttI it was necessary to be open and responsive to the research context as found. It was felt essential to be open to all phenomena as they were actually encountered, thus substantially reducing the risk of being overly prescriptive and missing potentially highly relevant information. For the

thesis research, this meant being within school contexts, both formal and informal, in which adolescent children were present, in order for a theory relating to PAttI and its conceptualisation to emerge. The purpose was to discover the theory implicit in the data. A sequential multi-method approach was used for data collection, with a progressive refinement of the research focus over the course of the studies.

Although much research had been carried out into the relationship of gender, attitudes and computers at the start of this research, the Internet was still novel in this regard at the commencement of the first study and frames of reference were few. The proposed construct of PAttI was also original to this thesis. Primary investigations were partially informed by prior research relating to gender, computers, attitudes and stereotypes (Barbra, 1990; Collis, 1985; Comber et al., 1997; Shashanni, 1994, 1997). However, since prior research specifically into the area of attitudes, gender and the Internet was negligible at this point, the research for this thesis was, to a great extent, exploratory.

As the thesis research work progressed, the findings iteratively helped to inform and refine the next phase. Thus, the exploratory, investigative and interview studies were primarily concerned with identifying the main attributes central to PAttI, defining and conceptualising it as a psychological construct and developing a well grounded potential measure. The main study then sought to apply and measure PAttI, testing it across a range of factors identified as probable variables suspected of influencing PAttI, such as context and experience, alongside the prime factor of gender. This, it was proposed, would provide an answer to the research question posed.

3.2.2 Data Collection Methods

In order to maximise the integrity and grounding of the eventual findings from the research, it was decided to take an approach of data triangulation, utilising

methodological tools from both qualitative and quantitative perspectives. Triangulation combines independent but complementary research methods, increasing the perspectives available on the issue of focus, and thus providing an increased robustness in terms of reliability and validity (Denzin, 1978).

Triangulation itself can be utilised both within and between methodological approaches. So, for example, this research used observation and interview techniques based upon qualitative approaches, offering differing perspectives and further insight; it also undertook questionnaire-based data collection, primarily quantitative. Triangulation was also used for this research as a practical solution maximising data collection, validating that data from differing perspectives and developing a robust, ultimately measurable, conceptualisation and psychological construct of PAttI. The pragmatist position of “whatever philosophical and/or methodological approach works for the particular research problem under study” (Tashakkori & Teddie, 1998, p.5) was adopted. This position underpins the mixed-methods paradigm (Tashakkori & Teddie, 1998) in which different approaches are employed in different phases of a study and data is integrated afterwards. Data collection methods applied thereby sought to combine the perceived strengths of both qualitative and quantitative approaches to the research, and to minimise their possible individual weaknesses.

The research was conducted in an educational context and open to the emergence of potentially relevant information. Further questions arose and developed alongside growing familiarity with the context. Following this, refinement of the focus upon areas identified as likely aspects worthy of further investigation, enabled detailed analysis and survey methods to be used to full advantage.

3.2.3 Qualitative Approaches

In exploratory research, where there are few existing state-of-the-art theories and a dearth of knowledge about a particular phenomenon, it is considered reasonable to start from a qualitative approach (Patton, 2002). At the start of the research for this thesis, the emphasis was therefore on exploratory and pattern seeking methods. This developed into the testing of theories, confirming possibly significant factors and relationships, considering new issues as they arose and evaluating the importance of contradictory cases. The main strength of this approach was the contextual foundation, since the developing conceptualisation and argument emerged directly from the situation of adolescents using ICT in schools.

The particular merit of qualitative research for this thesis lay in the advantages gained through enabling explorative techniques, particularly during the early phases. This allowed potentially relevant factors to be acknowledged as they occurred without pre-scheduling probable issues based purely on previous research. Within the boundaries of the research question then, the initial approach was explorative and open to emergent phenomena.

3.2.4 Quantitative Approaches

The utility of quantitative methods rests primarily in their function to enable the application of statistical analyses to numerically represented data, in order to describe or infer conclusions with statistically valid integrity. The ability to generalise the results from a representative population is therefore much more likely to be available than that of qualitative methods alone.

Quantitative measures were used in several ways. Firstly, by producing straightforward data relating to categories and numerical measures, such as gender of participant and extent of Internet use; and secondly, by enabling refinement, coding, and

analysis of data to produce statistical meaningful information, using Excel and SPSS computer packages. The latter process facilitated the development of a measure of PAttI.

3.2.5 Sampling

Initial sampling for the exploratory and investigative studies was across three school year groups, 8, 9 and 10, from the same school. This was focused down to 30 individuals from the same population for the interview study. In the main study, the sample was drawn from Year 10 pupils from four different schools, including the original participating school. The sampling objectives were to engage participants from the population of interest, adolescent school children, and develop the construct and measurement of PAttI with greatest ecological validity.

3.3 Data Collection Tools

Three main data collection tools were used; observation, interview and survey. The following subsections describe the characteristics that made these particular tools suitable for use in data gathering for this thesis.

3.3.1 Observation

Direct observation was used during the field observations for the exploratory study. This method tends to be more objective than participant observation and more focused (Trochim, 2001). It also can be of shorter duration. This meant it was a useful tool in the initial stages of the research, enabling information to be gleaned from a direct context. Field notes were captured by withdrawing at intervals and discretely making Dictaphone recordings and manual notes. These were transcribed within 24 hours of capture. An audio recorder was not employed *in situ* as this may have increased the participants' reactivity and threatened the validity of the data.

3.3.2 Interview

Both unstructured and semi-structured interviewing techniques were used. Unstructured interviewing is particularly useful for allowing a free flow of information and enabling relevant and interesting aspects which emerge to be pursued further (Trochim, 2001). This is a valuable technique for gaining broadly based insights into a phenomenon, and usefully contributed to the exploratory study.

Semi-structured interviews were utilised for the interview study. An interview protocol was drawn up based on the outcomes from the investigative study. This gave a consistent framework for the interviews, but was sufficiently flexible and non-prescriptive to enable adaptation to be made in response to individual interviewees. Interview questions were typically open-ended, and designed to engage the interviewee in expressing their responses to the interview protocol in a useful and informative way, without prematurely closing on areas of potential interest.

A process of thematic coding was applied to the data collected. Firstly, central topics were identified from the transcripts. Next, meaningful categories and their properties were identified and coded. This was followed by an interconnecting of categories and subcategories enabling, for example, the identification of common respondent characteristics such as gender. The principles of Berkowitz (1997) were followed; she suggests these questions should be asked when coding and analysing qualitative data:

- What patterns and common themes emerge in responses about specific topics? How do these patterns (or lack thereof) help to illuminate the broader study question(s)?

- Are there any deviations from these patterns? If so, are there any factors that might explain these atypical responses?
- What interesting stories emerge from the responses? How do they help illuminate the broader study question(s)?
- Do any of these patterns suggest that additional data may be needed? Do any of the study questions need to be revised?
- Do the patterns that emerge corroborate the findings of any corresponding qualitative analyses that have been conducted? If not, what might explain these discrepancies?

Retrieved 2nd November 2005, from:

http://www.ehr.nsf.gov/EHR/REC/pubs/NSF97-153/CIAP_4.HTM

3.3.3 Questionnaire

The use of a questionnaire to gather data in the investigative and final study provided several key benefits. In terms of practical issues, it enabled the collection of a substantial amount of data in a relatively short time, minimising the burden on teachers and children. It also permitted the analysis of data using statistical techniques from which verifiable inferences could be drawn. Most importantly, it was essential to the testing and development of the PAttI scale.

3.4 Development of the PAttI Scale

The detailed reporting of the development of a measure of PAttI appears over the following chapters; however, the general principles are described here. PAttI is a

psychological construct and as such is an abstract entity. This poses the problem of how to create a measure which actually measures the construct with validity and reliability, and how this can be verified. Each variable is considered an imperfect indicator of the construct (Cronbach & Meehl, 1955) as it will contain an element of random error. Thus the measure will itself also be imperfect, potentially containing not only a measure of the construct desired, but also superfluous constructs and random error (Judd & McClelland, 1998). It is by examining the covariances and correlations of the variables for evidence of convergent validity, discriminant validity and reliability that the case for construct validity can be made (Judd & McClelland, 1998).

Construct validity therefore refers to the extent to which the scale measures the abstract, theoretical notion which has been proposed. The construct of PAttI was argued in broad terms as having a relationship with voluntary participation with ICT, impacting outcomes in terms of intent, behaviour and equity of educational and professional participation. The attributes of the construct were proposed from the literature review and then further developed and refined by the exploratory, investigative and interview studies. These were then operationalised as questions on the scale. Construct validity was established by the extent to which inferences could then be made from these measures; that is, the degree with which the results support the theoretical construct.

Reliability in terms of scale quality will be indicated by the variance for the sum scale; this will be smaller if the items from the scale are measuring the same variability between subjects. Cronbach's coefficient alpha (Cronbach, 1951) was used to investigate the internal consistency of the PAttI measure at various phases of development, by providing the proportion of true score variance captured by the items and by identifying items failing to contribute to this in a meaningful way.

3.5 Effect Size

Tests of statistical significance estimate the probability that a result is due to chance. However, they do not necessarily give an actual indication of the value of the finding in practice. To address this, the outcomes of ANOVA tests for this thesis also present a statement of effect size to measure the strength of association, and thus the relative importance of the finding. Typically, eta-squared is the measure of choice in the education and psychology literature (Pierce, Block & Aguinis, 2004).

Pierce et al. (2004) presented a critique of researchers' tendency to report classical eta-squared in their findings, whereas they were in fact presenting partial eta-squared. The implications for this discrepancy are to be found in the different ways in which these measures are applied. Classical eta-squared is the proportion of the total variation attributable to the experimental factor in a value range of 0-1, defined as $SS_{\text{effect}}/SS_{\text{total}}$, where SS_{effect} is the variation attributable to the factor and SS_{total} is the total variation. However, in the case of partial-eta squared, it is the proportion of total variation attributable to the experimental factor, excluding other factors from the total non-error variation, and again with a range of 0-1. When a research design has only one factor, classical and partial-eta square are equal. Conversely, in a design with multiple factors, this is only true if the source of variance is the only source contributing to the total non-error variation. Otherwise, partial-eta square values can total to more than one; this is because it is not a unique measure of variation in the dependent variable, since other factors are also contributing to the non-error variation. Partial-eta squared is defined as $SS_{\text{effect}}/(SS_{\text{effect}}+SS_{\text{error}})$, where SS_{effect} is the variation attributable to the effect and SS_{error} is the error variation. The outcome of this is that partial-eta squared values in MANOVA can total more than 1, unlike classical eta-squared values (Cohen, 1973).

The importance of this distinction rests in the final interpretation of the strength of the finding. Pierce, Block and Aguinis (2004) cited cases in the literature in which partial-eta square strengths of association were erroneously reported as classical eta-square, with a subsequent inflation of the meaning of the result. However, Pierce et al. also assert that there are situations in which it can be preferable to report partial eta-squared, for example in a multifactor design when it is desirable to report the strength of association between an independent and dependent variable, exclusive of the variance produced by other factors.

The preferred index for strength of association reported in this thesis is partial-eta squared, η_p^2 . The strength of partial eta squared is interpreted using Cohen's 1988 guidelines (Cohen, 1988): .01= small effect size; .06= moderate effect size; .14=large effect size.

3.6 Summary

From the review of the literature, it has been proposed that the observed gender difference operating between the sexes in respect of computers can be described as arising from a relative lack of psychological access. Emerging from this, the question arose of whether the lack of psychological access to computer use evident in previous research across the last 25 years - evidenced by measures such as attitudes, voluntary access to ICT and behaviour by girls and women - would be replicated in an era witnessing the emergence of the Internet and bringing us into a new age of computers.

In order to answer the primary research question of this thesis cited at the end of the literature review, it was necessary to first develop a conceptualisation of the construct proposed, PAttI, and second to develop and test a measure of the construct itself in context. This was approached by a triangulation of open and initially exploratory

quantitative and qualitative measures focusing on the same phenomena, and grounded in the social contexts of interest.

CHAPTER FOUR

4 EXPLORATION OF GENDER AND ICT

4.1 Introduction

A lack of psychological access to ICT by girls and women, relative to boys and men, was implicated in the literature review, and considered together with issues of access, experience and the equitable implications across the life span of individuals. The literature suggested that the most salient developmental point at which psychological access becomes observable is during adolescence.

This chapter sets out the exploratory study, which aimed to explore the reality of ICT use by adolescent children in the everyday contexts of school and home, and to identify probable elements contributing towards a construct of PAttI for further investigation. The focus was upon gender, access, use of ICT and attitudes towards ICT, by adolescents at an English secondary school.

The exploratory study was intended to start from broadly-based explorations, informed by the literature review and a beginning conceptualisation of psychological access, using observations and informal interviews conducted during the course of field visits. These explorations were further refined and developed over the course of this study and during the following investigative study, presented in Chapter 5.

4.2 The Field Visits

The group under study comprised adolescent pupils in a school context, with gender, attitudes and ICT, providing the subject of examination. Eight whole day visits were carried out at a grant-maintained secondary school in Buckinghamshire, England, over a

three-month period during 1998. The school was a co-educational foundation comprehensive school for pupils aged 12-19, with a roll of around 1180.

Observational studies were made within classroom contexts where pupils were engaged in computer activity. The classes visited were those held in the Information Technology department, which formed part of the compulsory curriculum for all pupils. The facilities were also used to support other aspects of the curriculum such as foreign languages.

4.2.1 Context

Classroom observations were carried out across Years 8, 9 and 10, across an age range of 12 - 14 years, and with approximately 240 children in each year group. The year group was split into two bands of 6 groups. There were therefore 12 groups per year, consisting of pupils who were grouped by the Information Technology department according to ability. This was based on performance of tests for numeracy, literacy and verbal reasoning, which all the children took during the first two weeks of entry to the school. During the course of the whole day visits, observations were possible across all three years and ability groupings.

4.2.2 Procedure

The extent and situation of ICT and Internet usage amongst pupils were observed and their attitudes and interests relating to this were probed with the objective of developing an appropriate survey to explore and detail this further.

Pupils were observed within the school environment, both in lesson time and during free time such as breaks and lunch time when informal access to the Internet-enabled computer suite was available. Taped and written notes were made unobtrusively by

withdrawing at intervals. These were transcribed and annotated within 24 hours of each visit.

Free access was given by the school and no restrictions were made. It was possible to wander between classes and speak to pupils on all occasions. The researcher deliberately presented in a casually dressed manner as a student visiting from the Open University, in order to be distinguished from the teaching staff and to encourage engagement by the children.

4.2.3 Data

The first stage during each visit produced field notes observing overall impressions and thoughts about the contextual situation and the dynamics apparently at work. The second stage was to approach all the children informally as they were working and initiate a conversation, producing an unstructured interview in which there were some core opening questions, but no formal protocol. Depending on the responses, the questions asked started from a curriculum focus, for example, 'can you tell me a little bit about what you are doing today?', moving towards more individually focused questions such as 'do you use a computer at home?' and 'do you enjoy computers?' These were designed to elicit detail about children's feelings towards computers and to find out what, if anything, they were using computers for voluntarily. In some cases, children were working in pairs and were both engaged in the same approach by the researcher.

During each session, all of the children in a room would be spoken to. This was done in a discontinuous way, interspersed with periods of general observation and withdrawal from the room to make notes. The subject in progress was most often Information Technology, followed by Control Technology and Modern Foreign

Languages. The actual lesson content varied according to year group and stage in the curriculum syllabus.

The field notes were subject to a recursive coding, noting of repeated themes and new themes, as they occurred. Thus, although the primary method was unstructured interviews, enabling topic areas to be approached with breadth and supported by field observations and reflections, the analyses moved from initial open coding towards more selective coding. Over the course of the field visits, this procedure generated key themes emerging from the data relating to the pupils' gender and relationship with ICT. These themes are presented in the following section and related subsections.

4.3 Field Study Results

Several themes emerged as a result of the observations. These are summarised below with extracts from the field notes to illustrate.

4.3.1 Confidence

The greater enthusiasm and confidence displayed by boys relative to the girls, with reference to their computing activities generally, was notable:

I moved around the group [Year 10], asking several children what they were doing today. I then asked them how they were finding it. All of the boys were quick to say how easy it was – the adjective 'easy' was heard several times. The girls' most positive response was 'it's okay'. I considered whether this was 'male bravado'. However, it definitely appears that the boys were having little difficulty with the task. The task to me appeared very linear and logical, having commonalities with basic programming skills. I do wonder if this 'tainted' the girls' perception of the task.

The impression gained was that the degree of comfort within the context was greater for the boys than for the girls. It was difficult to conclude whether the apparent greater confidence of the boys was justified, or if the type of application was indeed gendered, producing a negative reaction in the girls. Overall, the boys it seemed demonstrated greater confidence verbally with ICT, regardless of their actual degree of applied ability:

Calm is resumed. I now ask various pupils in this group [Year 9] how they are finding it today. I've found this phrasing is suitably ambiguous not to focus them onto any 'expected' topic area. The response is the same as IT2. The boys are saying 'easy' and the girls at the most say 'okay'. The boys do seem to be finding it genuinely easy. Some girls are struggling, but those who are doing well never say it is 'easy'. No boys are struggling.

4.3.2 Relevance

The perceived relevance and degree of interest in computers displayed by the girls generally gave the impression of being less than for the boys. A girl from a Year 10 class was observed:

I've just had an interesting conversation with a girl who was struggling with the computer. She says she hates it, she's thick at it, it's boring, and she doesn't need it. When asked what she was good at, she told me P.E. and that she wanted to be a dancer when she grew up, and she wouldn't need to know how to use computers. She said she didn't care how rubbish she did at it because it wasn't important to her. She said the boy sitting next to her was very good at computers and said I should speak to him.

The lack of relevance of ICT seemed particularly felt by a sub-group of girls, who were actively disengaging from the lessons. It was not possible to ascertain whether they were disengaging due a genuine absence of perceived relevance for them, or if it was confounded by a lack of confidence and skill in ICT.

4.3.3 Situation

The dynamics within the school context, together with the style of the teacher were also notable for their effect on pupils:

Back in IT2, the class teacher, [teacher's name] and [teacher's name], are standing over the girl who was unable to get started. [Teacher's name] gets the database up and running, and says to the girl 'you've been practising this for weeks, you've done it umpteen times'. The girl is silent throughout.

Later on in the lesson, when the focus had been switched to other pupils, the researcher spoke to the girl involved:

In IT2 I approach the girl who was finding it difficult. I ask her if it's sorted out now. She says she doesn't know what he [teacher's name] did, 'he always shouts'. She says 'I don't like this, that's why I'm in this class. It's the thick class' (...). [Teacher's name] seems to have been deluding himself that the children are unaware of the ability streaming in operation! I find myself empathising with this girl's feelings. The men standing over her talking loudly in front of everyone, highlighting her computing inadequacies, surely served only to reinforce her low self-esteem in this subject. The teachers' frustration at being unable to get the girl to understand was very tangible; however, they seemed to me to see it as a problem wholly originating from her.

The observation served a useful purpose in pointing to possible contributing elements to PAttI. The effect of the situation and the male teacher's frustrations with the class gave the impression of having a greater impact upon the girls than the boys. It is difficult to assess exactly what variables may have been operating here. It could be argued that there are several coinciding factors. A relative lack of interest by some of the girls, together with an inability to 'tune in' to appropriate teaching strategies to engage pupils (particularly the girls) on the part of the teacher, are perhaps worthy of consideration. Also, it was impossible to tease out the separate factors at work here. There were problems relating to staff shortages and supply teachers with different specialisms:

It does appear to me that at least some of the pupils [Year 10] did not have an understanding of what it was they were supposed to be doing, or what the eventual curriculum aims were. It was as if they didn't know what either the immediate goal was, or the final one.

4.3.4 Internet Enthusiasm

There was overall enthusiasm of pupils of both sexes for anything relating to the Internet. Whilst frustrations were expressed about the slowness and problems encountered in surfing the Internet, interest was high, and attitudes appeared very positive. A Year 8 class was observed:

The class were looking forward to getting on to the Internet during this lesson. But [teacher name] had been advised by [teacher name] that there were problems, it was particularly slow, for example taking 10 minutes to load a single page. Despite this the children were having fun on the computer, mainly doing graphic-based, painting, drawing, type of activities (...) One girl expressed her disappointment that they weren't going to go onto the Internet this lesson. I asked her if she had been on it before; she hadn't yet, but she was

looking forward to it because a lot of people had been saying how brilliant it was.

[Teacher name] group are working on constructing their own web pages using an html editor programme under Netscape. I spoke to one girl who was doing very well on her web page construction. She told me spontaneously that she really liked computers. (...) The girl tells me that at home they have a laptop which she uses a lot for her homework and that they were hoping to get a home computer soon, and to go onto the Internet.

4.3.5 Internet Use

When using the Internet for school-related tasks, both sexes applied it in a way that related to their own personal and quite gender-specific areas of interest. For example, one task asked pupils to set information-seeking questions for other pupils to answer. This required selecting a topic area and there was a notable gender dichotomy in choices of Internet site. A Year 8 group was observed:

The boys are predominantly looking at games sites, football. Girls I notice are looking at 'The Titanic', the film, the romantic story. One girl is looking at a page for Leonardo DiCaprio, taking detailed notes. The class is working very well, very engrossed in what they are doing. Seem to be enjoying it. Some boys are on motor racing pages. Another set of girls are also doing 'The Titanic' and another set doing the 'Spice Girls' (...) I've noticed about three groups of the boys, separate groups, chose to go to sites relating to computer gaming; Duke Nukem, Sony Playstation, and another one. The gendered choice of Internet site is very, very obvious.

4.3.6 Home Access to ICT

There was an apparent variation in access, use, and support for information technology-related resources in pupils' homes and even some suggestion that within families' access and use was differentiated between siblings. A Year 10 group was observed:

I spoke again to the girl who was using the Internet at home. She told me about her younger brother who monopolises the machine for a lot of the time particularly for games use. He has created his own web pages but he won't teach her because he's anxious that she will then take over the machine from him! She asked what I was doing and I briefly explained I was doing research about children and computers. She said I ought to speak with her brother – she didn't recognise at all that I could be equally interested in what she was doing.

Later on the same day, observing a Year 9 group:

By coincidence this is the brother of the girl I spoke to earlier who used the Internet at home. It seems that she has alerted him to my presence and briefed him on my interest! He tells me about his computing abilities, his creation of web pages, his own chat room, and game proficiency.

He was very proud of his abilities and use of ICT, and gave the impression of being condescending towards his mother's and sister's choice of use, regarding them as impinging upon his proper use:

He says his mother and sister are really only interested in the Internet Relay Chat. This is indicative of some of the potentially significant areas for my research, I feel; the influence of prior home experience upon subsequent school-based attitudes towards the computer, especially the Internet and the differences

that may emerge in respect of gender use and appropriation of certain categories of Internet use.

4.3.7 Games

Detailed knowledge and interest in computer games seemed higher amongst the boys:

I turned to speak to the boy (Year 10). The boy said he wasn't allowed to take GCSE (computing) but he doesn't know why. He has got a computer at home, a PC, on which he likes to play games every night with friends, particularly 'shoot'em ups'.

Many of the girls also said they played games, but the level of interest and dedication to this type of use appeared relatively less. There also seemed to be indications of a dichotomy of use between the boys and girls, in informal situations:

In an adjacent classroom, another class is also working on databases. I spoke to a girl (Year 10) who explained what she was up to on the database. I asked her whether she used the Internet; she said not yet at [school name] but she does at home, where she uses it for accessing information for homework and also chatrooms.

4.3.8 Informal School Access

The school had an open access policy to the main computer room during lunchtime. Previously, they had a restricted girls' only access on certain days, in order to encourage the girls to use the facility. This had been so successful that the IT co-ordinator decided it was no longer necessary to continue the practice. However, during the observations it was apparent that boys dominated the facility again:

The children have open access to the computer room at this time, but the Internet is off. Only boys in the room and there's repeated disappointment that the Internet isn't available. One boy wants to access his email, and is very unhappy. One of the boys' immediate questions is whether or not I am a teacher. It seems quite important that they put me in some appropriate category. I think they seem to pretty much relax towards my presence when I explain.

Again the preferred type of use was often different between the girls and boys:

Noticeable absence of girls, not choosing to come here during this 'free time'. I asked [teacher name] about this later, and he said the girls did sometimes use the computers during lunch, but it was usually when they had some pragmatic reason for doing so, like a school project they were working on. Also, it tended to be the same boys regularly using the computers.

They [boys] are doing some 'fun things' like putting Homer Simpson's head onto a girl's body on a photo on the screen. Others say they are doing homework. Not sure about that.

4.4 Summary of Field Visits

In summary, the field observations suggested some key areas that had potential relevance to the construct of PAttI. The boys displayed greater confidence, knowledge and enthusiasm for computers generally, as suggesting in previous research (Millard, 1997; Shashanni, 1997). Differences in the degree of perceived relevance of ICT to individuals were also noted. Both sexes, however, seemed similarly enthusiastic about the Internet, although their choice of activity and browsing of sites was noticeably

gendered. In the 'public' context of the classroom no examples of children crossing these gendered boundaries was observed, with one exception:

[Another pair, boy and girl, working together, subject 'The Titanic', Year 8]: when I ask them who chose, the boy waved his thumb towards the girl, looking slightly embarrassed and as if he wanted to disclaim responsibility. This particular pair is actually sharing a chair, and they're obviously very relaxed together, leaning against each other. The personal space boundaries one might expect are not there. Much amiable debate between the pair about exactly when The Titanic sunk.

In this case, it can be argued that the apparent relationship between the pair overrode other potentially inhibiting aspects in respect of gendered choices of computing activities.

The actual context in which computers were encountered (home, school) seemed to be of particular relevance to the girls. However, they still appeared less willing than the boys to engage voluntarily with ICT in either context. The effect of others (teachers, pupils) also appeared to impact more upon girls' willingness to engage with ICT, and their sense of confidence. This suggests issues of anxiety, relating perhaps to gender identity and areas labelled appropriate for interest and activity, are made more salient for the girls, particularly in a public arena (Archer & Macrae, 1991; Brosnan, 1994). In respect of the observations included here as examples of typicality, consideration has been given to the potential for bias. In some respects, it can be argued that with one single observer, with a particular focus of interest, a degree of observational bias is actually a prerequisite feature of the data collection, as in the notion of a 'sensitising concept' (Van den Hoonaard, 1997). However, in evaluating the weight of the observations used to illustrate this chapter, they were selected on the merit of their

overall typicality. Other observations were made, which were of potential interest, but failed to be repeated or were not sufficiently relevant to the explicit purpose of the field visits and were not therefore rated as having the same degree of potential importance for the study. For example, the effect of a situation, staff shortages, on other aspects was noted, such as pupil behaviour:

Not quite sure what's happening here. Two boys have been excluded from the classroom. The supply teacher's over-zealous disciplinary reactions with the children don't seem to be going down too well. I later asked [teacher name] what had happened and he told me they had been fighting and messing around so he had 'chucked them out'. [Teacher name] tells me this is the worst group for discipline problems.

It seems to me that some of the children are actually struggling with the work and probably need a lot more support than is practically available for them. Some of the children are getting on really well with the exercise in hand, and others still haven't started and are struggling with the data form on the screen. They don't really understand what they're supposed to be doing. Looking very fed up and bored. I think this is contributing to the problem. In particular the supply teacher seems to have a problem with one of the children's voices which was loud, and very deep. He wasn't particularly shouting, it just seemed to carry a long way! One of the excluded boys comes in and asks if he can please borrow a pen. Without looking up (he has been sat down working on some papers) the supply teacher shouts "get out". (...) The supply teacher has now been replaced by another teacher who appears to be a member of staff. In the meantime (teacher name) has been dipping in and out

helping children who have got stuck. The problem of staff shortages is quite great, I think.

The field visits, observing and talking to adolescent children in an educational context, enabled a preliminary view of potential aspects contributing towards PAttI to emerge. Observations produced data which suggested probable aspects of PAttI, including evidence of the importance of the situational context upon girls. Broad themed areas were therefore identified from the field observations for further, detailed, investigation:

Confidence: Boys' confidence levels with ICT generally presented as higher than the girls. This reflects the consensus of evidence from prior research showing boys' greater confidence with computers (for example, Collis, 1985; Colley and Comber, 2003; Comber et al., 1997; Millard, 1997; Okebukola, 1993; Shashanni, 1993, 1997; Siann et al., 1990).

Relevance: Some girls gave the impression that ICT was of less relevance to them and expressed a disinterest in future use. Murphy and Elwood (1998) point to evidence showing that girls are more likely than boys to take account of the circumstances surrounding a task, as opposed to abstracting the task from the actual context. The relevance of the task within a particular set of circumstances is important to the girls, whereas Murphy et al. describe the boys as considering issues in isolation with the content and context being irrelevant. The issue of personal relevance may therefore be indicative of a gendered dichotomy of salience; this may in turn relate to the matter of psychological access and differential outcomes.

Situation: In the formal teaching situation, there was some evidence of an effect of gender negatively impacting upon girls. This appeared to relate to male IT teachers' frustrations with girls who were uninterested in the way they presented the subject.

The impression gained was of girls choosing to withdraw from the situation and a further decline in confidence. In research by Culley (1988), the author considered that the mathematical background of computing teachers was often influential in the content of lessons. It can be speculated that the situational impact of gender made in the study reported in this chapter may be reflecting similar, if not so specific, elements of the differing gendered experiences of male teachers; thus influencing the teaching styles and learning resources applied by them in the classroom context. Dain (1991), addressing the issue of the declining presence of women on computing courses, recommended that school teachers should review both method and context of their teaching, endeavouring to also include material on the social and political nature of computer use. Culley (1988) observed that most teachers did not seek to accommodate girls' interests within the curriculum. Similarly, Millard (1997) has also noted a relative lack of authentic learning tasks with computers in secondary schools. The field study observations suggest that little has changed.

Internet Enthusiasm: Previous research with respect to computers has indicated that girls are less likely to express interest and pleasure in using a computer (for example Collis, 1985; Okebukola, 1993; Shashanni, 1993; Shashanni, 1997; Siann et al., 1990). Despite the gender differences observable in computer use, both sexes in the field visits expressed great enthusiasm with regard to the Internet. This could have been an early indication that the Internet may present a more positive outcome with regard to the impact between the sexes, than that previously of the computer *per se*.

Use: The girls and boys showed a distinctly gendered approach to the use and exploration of the Internet, using it to support and access areas of interest that were notably divided, with a stereotyped 'girls' topics / boys' topics' split. There was also

some indication that the girls were interested in the more communicative aspects of the Internet, for example chatrooms. Colley and Comber (2003), revisiting the question of age and gender differences in computer use and attitudes among secondary school students, found evidence of a reduced gender gap for certain computer applications. Moreover, for contemporary applications, such as email, accessing the Internet, use of CD-ROMs, no overall gender difference emerged for frequency of use. Millard (1997) proposes that when girls have unrestricted access then they adapt the culture of computing to their own purposes and interests. This is perhaps indicative of the importance of considering the informal context in evaluating actual take-up, usage, and possibly adaptive behaviours, in respect of the relative impact of the Internet between the sexes.

Home Access: Previous research has indicated that boys frequently have greater home access to computers (for example, Campbell, 1989; Chen, 1986; Colbourn & Light, 1987; Culley, 1988, 1998; Durndell, Glissov, & Siann, 1995; Millard, 1997). However, what emerged from the field visits was that the simple presence of a computer, possibly with Internet access, was not a straightforward indicator of *actual* access by an individual. Real access, as evidenced by actual use and frequency, together with the degree of priority given to an individual within a household, were identified as strong variables which would need to be considered at the next stage of the research.

Games: Although both sexes expressed an interest and liking for computer gaming, the boys were far more extreme in their response. This reflects the greater use of computers for gaming by boys, relative to girls, often found in the literature. Colley and Comber (2003) found that boys used computers outside of school more than girls, especially for games. However, Durndell et al. (1995) report that within school

there was no significant difference in the use of computers for games. This again points to the differing impacts of context of use. It is difficult to say whether it is simply a matter of lack of opportunity for certain types of application of use in school, although this would be plausible, or the result of an active choice. What is clear, however, is the differing weighting given to the desirability of game playing, at least outside of school. In the case of the field visits, the extreme response by the boys is suggestive of potential gains in computing interest, positive attitudes and experience generally. It remains to be seen whether these will also relate to Internet use.

Informal School Access: Where were the girls? Despite providing quite extensive informal access to ICT and the Internet, there was limited take-up of this opportunity by the girls. This poses the question of why; did the girls choose not to be there, or were they excluded in less than obvious ways? Previous research has shown a similar absence. For example, Arch (1989) found that at college level female students were not taking advantage of the informal availability of computers. Culley (1988) also noted that in optional computer activities, such as computer clubs, girls were in a small minority; and Durndell et al. (1995) found that boys reported using computers more frequently outside school. The importance of this theme is suggested by Millard (1997), who described evidence to support the notion that boys develop greater relative experience through their informal access to computers outside of schools. In addition, Shashanni (1993) indicated the importance of gender-role socialisation and the significant impact of this upon attitudes towards computers, as expressed in terms of interest, confidence, and stereotyping. The lack of voluntary presence by girls here may be the overt expression of such attitudes. However, Siann et al. (1990) observed that the boys in

their study tended to physically crowd the girls out. It can be proposed that the absence of girls is not due to unique areas of causality, but more likely attributable to a combination of factors.

The next chapter presents details of the investigative study, building upon the findings of the field visits and thus developing the conceptualisation of PAtI further.

CHAPTER FIVE

5 INVESTIGATION OF GENDER AND ICT

5.1 Introduction

Findings from the exploratory study were used to design a survey questionnaire, focusing upon several likely key areas relevant to the construct of PAttI as identified and detailed in the preceding subsections.

At this stage in the research the primary purpose of the survey instrument was to explore the key areas suggested by the field observations by operationalising potential aspects of PAttI through explicit questions relating to these key areas; thus enabling further systematic data collection and analyses to be carried out to a finer degree of granulation. The purpose was both to expand upon the key areas of interest resulting from the field study and to provide a triangulation of findings, ensuring that any developing model of PAttI would be well grounded in the data.

5.1.1 Survey Design

The survey design was approached by combining both closed and open-ended measures. It was anticipated that this would provide the most complete picture in what was still essentially an exploratory study. By obtaining easily quantifiable information complemented by a range of open-ended questions, which would not foreclose too soon on potentially interesting themes, the scope of the study was maximised.

The questionnaire, Appendix A, on which this survey was based, drew upon the observations from the field study, whilst retaining a large element of exploratory measures influenced by the review of the literature in Chapter 2, such as consideration

of physical access, affective, stereotypical and attitudinal responses. The following overview indicates the areas of prime focus explored in relation to gender:

- **Access to a Computer at home:** not simply the presence of a computer, but the ownership, location and use. This enabled the extent of actual practical access by individuals to be gauged, rather than mere potential access, which would have been the outcome from simply asking if they had a computer at home.
- **Internet at home:** whether there was Internet access in the family home. The extent of direct access to media technology generally – by asking whether they had in their bedroom their own : radio, CD player, cassette player, television, games machine (e.g. Sony playstation, Nintendo) or VCR. This was to distinguish the relative place of ICT in adolescents' lives.
- **Affective response to computer use:** in terms of preferred types of use (liking/disliking).
- **Affective response to Internet use:** in terms of preferred types of use (liking/disliking).
- **Attitudes towards the Internet**
- **Stereotypes held in relation to the Internet users**

The first two areas highlighted above were designed to cast light upon the overt evidence for PAttI, indicated by measures of external engagement with ICT, particularly in voluntary contexts. Previous research has used various measures of access, often those such as straightforward computer presence in the home or location of the computer in the home. The measures used here however endeavoured to tease out the real extent of access and use, distinguishing clearly between potential versus actual access. For example, Shashanni (1994) found that although half of the female students

in her study reported owning a home computer, only 15% considered that they were the primary users.

The Internet-related questions, whilst essentially exploratory, applied the lessons learned from the literature and also endeavoured to demark real rather than potential access and to measure the experience of individuals by the extent of their computer and Internet use. This represented a foundation on which to begin to deconstruct the notion of a circular argument often present in the literature, relating to experience as proposed to leading to positive attitudes and thus encouraging further experience, and so forth. As some studies have indicated, gender differences in ICT attitudes appear to disappear when taking account of relative experience (for example, Chen, 1986; Colley et al., 1994; Littleton & Hoyles, 2002); however, the impact of context and actual take-up of potential computer access has too rarely been included in analyses.

The remaining areas sought to further explore and clarify the latent elements which were theorised as being probable candidates contributing towards the construct of PAttI. These encompassed key issues and debates relating to gender and computers emergent from the literature, as outlined in Chapter 2. Attitudes, as expressed via overt means, for example behaviour, and inferred attitudes such as can be drawn out by scales, were explored in relation to both computers and the Internet, alongside an attempt to draw upon potential affective aspects. This approach reflects the tripartite view of attitudes (for example, Breckler 1984).

Stereotypes, suggested by the literature as another key issue in the gendering of ICT, were also explored. Again, a mutually reinforcing cycle in the acquisition of stereotypes has been proposed in the literature (Bodenhausen, 1988) with attendance to more salient stereotypes adding to their cumulative force. Bem (1993) suggests that cultural meta-messages about gender become internalised by the individual and

integrated into their identity; thus, information in the environment is viewed and evaluated in those gendered terms.

One major problem across the literature has been the variation in definitions (Kaye, 1992; Morse & Daiute, 1992) and measures of attitudes. For example, Kaye (1992) identified 14 differing approaches towards measurement and Brosnan (1994) concluded that no universal consensus on the relative strength of various dimensions, for example attitudes and experience, had been reached. The exploratory approach underlying the study reported in this chapter sought to encompass the key issues highlighted in the literature review, whilst also attempting to address some of the perceived shortcomings, in order to produce a comprehensive and clear picture on which to build towards a thorough conceptualisation of PAttI. The next subsection gives details of how the questionnaire was designed to investigate all these areas of interest.

5.1.2 The Questionnaire

The questionnaire (Appendix A) was designed in five main parts, preceded by a preliminary section to gather demographic data. The overall appearance of the questionnaire was intended to be visually engaging and ‘child’ friendly.

Part One

The extent of access to a computer in the home and also Internet access was established. The type of computer, in order to distinguish between PCs and dedicated games consoles, its location, and main user, were all identified, with the objective of finding out the real extent of participants’ computing access.

Part Two

This section ascertained participants’ access to media technology generally, by asking about their ownership of specific items, for example radio, television, games machine, located in their own bedrooms. This seemed the most efficient way of establishing

primary ownership for such items, in situations where shared access, or potential access, could confuse the issue. The objective was to try to discover more about the overall media context in which information technology was becoming a presence in the lives of the participants, and to look for potential indicators relating to gender and developmental differences.

Part Three

This section had one broad theme, which aimed to examine the participants' preference of computer and Internet use. The objective was to discover the uses to which participants would put access when given a choice.

Part Four

Participants' attitudes toward the Internet were examined by presenting them with an attitudinal scale with a fixed range of five possible responses. The attitudinal measures comprised 16 items suggested by an examination of the literature review and initial outcomes resulting from the field observations. The objective of the attitudinal measures was to explore a potential preliminary scale to enable the measurement of PAttI, with consideration of the likely attributes comprising the construct.

Although no direct use could be made of the attitude scales from previous research, since these did not relate specifically to the Internet, there was inevitably a degree of influence upon ideas during the development of the initial questionnaire items. The following research studies and cited questions were particularly germane:

Levin (1989, p.74)

‘When I get older, I’d like to work with computers’

‘The computer is most suitable for girls’

‘The computer is most suitable for boys’

Siann (1990, p.187)

‘Girls are better with computers’

‘Boys are better with computers’

Okebukola (1993, p.185)

‘The world would be better off if computers were never invented’

‘Working with computers is not my idea of fun’

‘People managed before computers, so computers are not really necessary now’

‘Computers will never interest me’

‘Computers are fun’

‘People who like computers are not often sociable’

Shashanni (1993, p.172-173)

‘I enjoy working with computers’

‘Men make better computer scientists and engineers than women do’

‘I feel confident about my ability to use a computer’

‘I feel helpless around computers’

‘Computers do not interest me’

‘Computers are exciting’

‘Computers are boring’

The questionnaire items represented five negative statements, five positive statements, and six sex-stereotyped statements that consisted of three which were positive for the girls and negative for the boys, and three which were positive for boys and negative for girls:

People who use the Internet are fun to be with
The Internet will make the world a better place
People who use the Internet are boring
The world would be a better place without the Internet
When I grow up I would like to use the Internet in my work
The Internet is less fun for boys than for girls
The Internet has more interesting sites for boys than for girls
I wish I never had to use the Internet
I enjoy using the Internet
I hate using the Internet
Girls are not interested in the Internet
Boys like the Internet less than girls
I find it easy to use the Internet
I find using the Internet difficult
Girls are better at using the Internet than boys
Girls use the Internet only when they have to.

These were intended to encompass broad themes: Personal Relevance, Gender Perception, Social Perception, Internet Enthusiasm, Affective Response, and Confidence. There was evident potential for overlap between these aspects.

The attitude items were presented to two holders of a PhD and two PhD research students for comment and also piloted for individual understanding and feedback from five children aged 11-15.

Participants were required to indicate their degree of agreement with the items by selecting a response from a 5-point Likert scale which expressed their own opinion with the statements presented. The possible responses were:

Strongly Disagree

Disagree

Not Sure

Agree

Strongly Agree

Part Five

Participants were presented with a brief vignette of a proposed ‘typical Internet user’:

Somebody is very interested in computers. This person spends a lot of time on the Internet, looking at interesting web pages, joining in chat rooms, sometimes playing games, finding out information for homework, and emailing friends. What do you think this person looks like? Please do a quick drawing below or write a short description. This can be in any style you choose.

The aim of this section was to present the participants with a stimulus to provoke an insight into their stereotypes about Internet users by inviting them to draw a picture of, or describe, an Internet user from given attributes and characteristics. Specifically, the gender stereotypes held, and positive or negative images of Internet users, formed the basis of investigation for this section.

It was decided to allow the participants to respond either in writing or by a drawing in any style, in order to maximise responses by explicitly permitting them to answer in a way with which they felt most at ease.

5.2 Survey Procedure

The questionnaire was administered by the researcher during lesson time in the presence of a teacher, with a typical completion time of 15 minutes. The researcher explained that the questionnaire was about children’s use of media and technology and requested their assistance whilst pointing out that their participation was voluntary. The participants

were asked to complete the questionnaire on their own, without consulting others, and were encouraged to ask the researcher for clarification of anything they were unsure about. They were assured of the anonymity of their responses, which would not be personally attributable, and advised that they could change their mind about taking part in the research at any point. The children appeared enthusiastic about taking part and no child declined or withdrew. Whole class samples, excepting usual absences, were therefore collected.

5.3 Survey Participants

A total of 123 participants, from the same school used for the field visits, took part in the survey. The age range was 12 to 15 years. The sample consisted of six classes, two from Years 8, 9 and 10, from a potential pool of 36 classes overall. The school streamed their pupils according to ability, and the participants were from the mid-range of classes.

Spoilt questionnaires (n=14), such as those with vital omissions and those containing contradictory data, were discarded. It is not possible to discern whether these were accidental or deliberate occurrences. Table 5.1 illustrates the descriptive characteristics of the remaining participants, in terms of sex and school year.

Table 5.1 Number of Participants in Survey

Year Group	Boys	Girls
Year 8	20	17
Year 9	24	15
Year 10	17	16
Total	61	48

5.4 Background to Survey Analysis

The data collected fell into four basic groups; demographic, categorical, attitudinal, and stereotypes. Demographic data related to the sex and age of the pupils. Categorical

items covered a range of data, for example relating to computer and Internet access, location, use, and main user in the home, producing descriptive statistics. Attitudinal measures comprised responses to the 16 stimulus statements on a Likert scale. Stereotypes related to a stimulus text and the participants' response to this.

Data from the successfully completed questionnaires (n=109) was entered into a computer spreadsheet and coded appropriately to enable analysis using SPSS Version 10 and Excel.

The following sections present the results of the survey questionnaire, starting with the descriptive data relating to access, types of use, and then going on to examine the attitudinal items and finally the stereotypes section.

5.5 Survey Results – Categorical and Descriptive Results

The following subsections present the results of parts 1-3 of the questionnaire, detailing the degree and type of computer and Internet access by the participants; their access to media generally; and their voluntary preferences of use for a computer and Internet access.

5.5.1 Computer Access at Home

The extent of potential available access to a computer in the home was examined by firstly establishing the presence, or not, of a computer there. Next, the degree of actual access, by examination of the location plus participant perceptions of ownership and dominant user within the home, were examined. Finally, Internet access of participants with a computer at home was established.

5.5.2 Participants General Access to a Computer at Home

A total of 79 participants (boys=38; girls=41) reported the presence of a computer in the home. The difference between the sexes was found to be significant, ($\chi^2=7.20$; d.f.=1;

$p=0.007$). Girls (85%) exceeded boys (62%) for the presence of a computer in their home.

The result was unexpected; previous literature has indicated a predominance of boys' access to computers at home. An examination of the data with regard to the year group of the children found that the girls in Year 8 (88%) were significantly more likely to have such access than the boys (40%), $\chi^2=9.09$; d.f.=1; $p=0.003$. In Year 9, the girls were still ahead but the difference was not statistically significant. By Year 10, the degree of access between the sexes was comparable, with 81% of girls and 82% of boys reporting the presence of a computer in the home.

One of the key aspects within the survey questionnaire and in the subsequent analysis was the clear demarcation between personal computers and dedicated games machines. It is possible that this has been an area of obscurity in some previous studies, for example Levin and Gordon (1989) and Robertson et al. (1995a).

5.5.3 Extent of Real Computing Access in the Home

The next questionnaire item sought to establish the true degree of physical access to a computer within the home. Participants identified as having access to a computer in the home ($n=79$) were asked which room it was in. From this, five categories of response were generated from the data:

Study

Family area (for example a lounge or kitchen)

Opposite sex sibling

Same sex sibling

Own bedroom

Table 5.2 illustrates the distribution between the sexes of the location of the computer in homes. No statistical difference was found overall. The location of the computer which was cited most frequently by girls and boys was within a family area.

Table 5.2 Location of the Computer in Pupils' Homes

	Study	Family area	Opposite Sex Siblings room	Same Sex Siblings Room	Own bedroom
Boys	16%	50%	5%	5%	24%
Girls	17%	49%	7%	0%	27%

5.5.4 Real ownership of the computer in the home

In order to examine further the true degree of access and perceptions of access, participants were asked to whom the computer in their home belonged. Table 5.3 illustrates the range and distribution of responses generated from the data for those participants who had indicated that there was a computer in their home. No statistically significant differences were found.

The most popular perception of ownership amongst the participants who had access to a computer at home was the ‘whole family’, except in Year 9, where girls perceived their fathers as owning the machine. The difference was minimal, with 31% of Year 9 girls holding this view, compared to 30% of Year 9 girls who perceived the whole family as owning the machine. Across all years, girls who had access to a computer at home outnumbered boys in perceiving the computer as belonging solely to them. However, whilst these figures are of interest, they cannot be given much interpretive weight, given the lack of statistically valid inference available.

Table 5.3 Ownership of the Computer at Home

	Same sex parent	Opposit e sex parent	Same sex sibling	All siblings	Whole family	Other	Pupil only
Year 8							
Girls (n=15)	7%	20%	0%	7%	53%	0%	13%
Year 8							
Boys (n=8)	13%	13%	12%	13%	49%	0%	0%
Year 9							
Girls (n=13)	8%	31%	0%	0%	30%	8%	23%
Year 9							
Boys (n=16)	13%	6%	6%	6%	50%	6%	13%
Year 10							
Girls (n=13)	0%	8%	0%	8%	53%	0%	31%
Year 10							
Boys (n=14)	14%	0%	0%	14%	58%	0%	14%

5.5.5 Participants' Internet access at home

Twenty-four per cent of boys (n=9) and 17% of girls (n=7) with a computer at home also had Internet access at home, a result which was not statistically different. Year 9 boys were most likely to have Internet access (31%, n= 5) and Year 8 girls (13%, n=2) the least likely.

5.5.6 Extent of Media Technology Ownership

In order to ascertain participants' access to media technology generally, they were required to indicate whether in their bedroom they had their own:

Radio

CD player

Cassette player

Television

Games machine (e.g. Sony Playstation, Nintendo)

Video cassette recorder

Examination of the extent of participants' ownership of media technology within their own bedrooms shows some noteworthy patterns between the sexes within school years, as shown in Table 5.4.

Firstly, in respect of girls, the data indicated a greater extent of ownership in Year 8 for the more sophisticated items of media technology (CD player, TV, and VCR) in contrast to the boys. Of these, VCR ownership by girls in Year 8 was significantly greater compared to the boys ($\chi^2=4.98$; d.f.=1; $p=0.026$). In Year 10 the only item showing an increase was the CD player.

In respect of the boys, the greatest ownership of media technology occurred in Year 9. This may be due to a developmental effect between the sexes. Ownership of a CD player, similarly to the girls, peaked in Year 10. There was a statistically significant difference for Games Machine ownership in Year 9, ($\chi^2=5.65$; d.f.=1; $p=0.018$), with boys' ownership exceeding that of girls.

It can be argued that there is a similar cohort effect operating between the sexes here, with an interaction of age perhaps attributable to developmental factors. This gives important indicators for further investigation. If there is a cohort effect, it could be proposed to have a relationship with positive outcomes for psychological access to ICT in respect of girls, particularly access to the Internet as the new medium of interactive communication and information retrieval. This would however only become clearer across time as part of a longitudinal study.

Table 5.4 Media Technology in Participants' Bedrooms

Media	Year 8 Girls (n=17)	Year 8 Boys (n=20)	Year 9 Girls (n=15)	Year 9 Boys (n=24)	Year 10 Girls (n=16)	Year 10 Boys (n=17)
Radio	94%	95%	100%	100%	100%	100%
Cassette Player	88%	90%	100%	100%	100%	100%
Games Machine	76%	80%	53%	87%	56%	71%
CD Player	94%	85%	80%	92%	100%	94%
TV	100%	90%	73%	92%	75%	88%
VCR	76%	40%	44%	58%	63%	41%

In Year 8, the ownership of a dedicated games machine was unexpectedly similar between boys and girls, at 80% and 76% respectively. By Year 9, a gap had developed, with only 53% of girls compared to 87% of boys having their own games machine. In Year 10, the boys still outnumbered the girls at 71% compared to 56%. It remained unclear from the small and select numbers involved whether this was again indicative of a potential cohort effect, with the younger age group girls having a more positive exposure to the computer games domain than the older girls; or if the desirability of a games machine simply declined for the older girls.

What is apparent from these results is that there is a gender difference in access to a dedicated games machine in the group under study, which is not reflected by access to media technology more generally.

5.5.7 Preferred Uses of Computers and the Internet

This section looked at participants' purpose in use of computers and the Internet, considering types of use and preferred activities. Difficulties experienced in analysing

the open-ended questions in Part 3 of the questionnaire demonstrated that, with hindsight, more pre-structuring would have been useful. The challenge was to maximise the explorative aspects of the study, not foreclosing too soon on potentially relevant information. However, a combination of closed responses with definitional examples, combined with an 'other – please state' category may have been more useful.

5.5.8 Types of Computer Use at Home

Data to inform answers to the question of computer activity by individuals was generated by asking the participants to state what they used it for. It proved difficult to develop categories of response to which a quantitative analysis could then be applied and valid conclusions reached. Most participants gave multiple and varied descriptive responses, to which meaningful individual weightings could not be given. However, examination of the data showed that around two-thirds indicated that usage of the computer at home encompassed both activities relating to school and also leisure activities.

5.5.9 Preferred Uses of a Computer

'Games' formed the most popular computer activity for both sexes, with 87% of boys and 67% of girls identifying games as their favourite activity ($\chi^2=6.40$; d.f.=1; $p=0.01$). Since games have been implicated in gains in computer liking and experience, it could be argued that this may have relevance to informal routes in relation to PAttI.

5.5.10 Favourite Uses of the Internet

Internet use in the school was a relative new introduction into the school timetable. In view of a comparative lack of Internet experience in the Year 10 participants, due to the fact that they had not yet reached the appropriate point in their curriculum timetable for the year, they were excluded from this analysis. This ensured that all the participants

within this analysis had at least some Internet experience. From the data collected, four categories of response from Years 8 and 9 were generated to which analysis could be applied:

Finding Out / Information Seeking: for example, information on things I like', 'finding out stuff'.

Communication with Others: for example, 'chat', 'sending messages'

Computer Games Related: for example, 'playing online games', 'cheats')

Other: for example, 'being able to go to my favourite programs web site'

Table 5.5 details the participants' responses. The most frequently cited category was 'Finding out/Information seeking', except for the Year 8 girls where 'Communication with Others' was the favourite use of the Internet. This may have been an early indication of a cohort of girls adapting to and using the Internet to support their own interests. More detailed examination of the frequency and nature of communicative use could illuminate this aspect further.

Table 5.5 Favourite Uses of the Internet

	Communication with others	Computer games related	Other	Finding out/ Information Seeking
Year 8 girls (n=10)	82%	0%	0%	18%
Year 8 boys (n=13)	8%	0%	23%	69%
Year 9 girls (n=13)	15%	8%	8%	69%
Year 9 boys (n=21)	24%	5%	10%	61%

5.6 Survey Results - The Internet Attitudinal Scale

The 16 attitudinal items were examined for their scale potential. In order to maintain a unified direction during analysis the values were reversed scored for negative items. Similarly, the stereotyped items that were negative for the girls and positive for the boys and vice versa were encoded according to the gender of the respondent.

5.6.1 Reliability

The internal consistency of the attitude questions as a potential scale was measured using SPSS by carrying out a reliability analysis to calculate Cronbach's coefficient alpha for the scale overall. This produced a result of .61 which falls below an ideal minimal value of .70 or greater (Nunnally, pp.245-246, 1978; Robinson, Shaver, & Wrightsman, 1991), in terms of the scale's reliability as a homogeneous measure.

Individual items were examined for their negative impact upon the final alpha value which would result in an increase in the final alpha if they were removed. Items with such an impact were found to be those with a gendered element to the question wording:

Boys like the Internet less than girls

The Internet has more interesting sites for boys than for girls

Girls are not interested in the Internet

Girls use the Internet only when they have to

Girls are better at using the Internet than boys

This indicated that the gendered items were failing to contribute to the value of the scale. All six gendered questions were therefore removed from the next stage on analysis, including the item:

The Internet is less fun for boys than for girls

The remaining attitude items were again measured using SPSS for internal consistency using Cronbach's coefficient alpha, producing an acceptable alpha value of 0.78.

5.6.2 Principal Components analysis

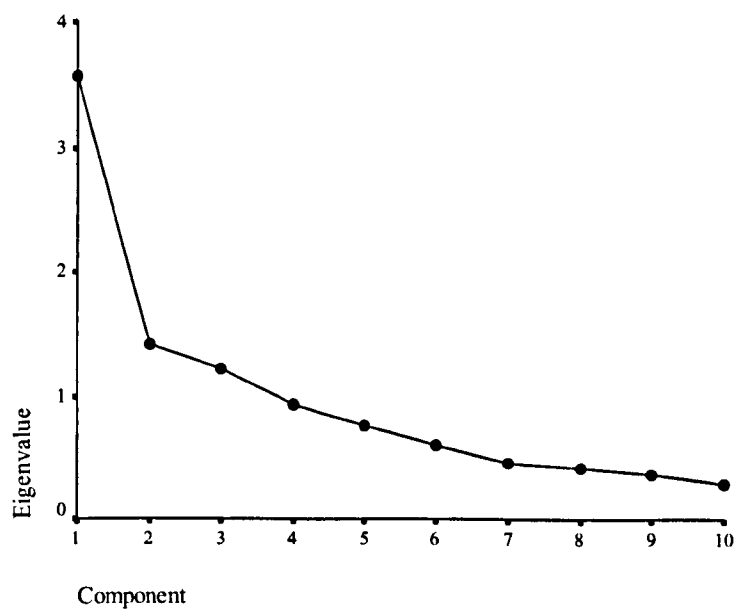
The 10 remaining items from the attitudinal scale were subjected to principal components analysis using SPSS. The suitability of data for factor analysis was assessed.

The determinant value of the correlation matrix was 0.0516 which is greater than the necessary value of 0.00001; therefore multicollinearity was not an issue for this data. The Kaiser-Meyer-Okin value was .746, exceeding the recommended value of .6 and is defined as ‘good’ (Field, p.455, 2000) meaning that distinct and reliable factors should be generated. Barlett’s 1954 Test of Sphericity (Field, p.457, 2000) reached statistical significance, supporting the factorability of the correlation matrix.

Principal components analysis revealed the presence of three components with eigenvalues exceeding 1, accounting for 62% of the overall variance, with component values of 36%, 14%, and 12% of the variance respectively.

Inspection of the screeplot illustrated in Figure 5.1 using Cattell’s Scree test (Kline, p. 75, 1994) confirmed that three components should be extracted.

Figure 5.1 Scree Plot



5.6.3 Oblique Rotation

To aid in the interpretation of the three components, an oblique rotation, SPSS Oblimin, was performed revealing a simple structure.

Component 1 consisted of six items. Table 5.6 presents the content of these items, together with their respective loadings. Component 2 consisted of two items; ‘The world would be a better place without the Internet’, loading =0.87, and ‘The Internet will make the world a better place’, loading =0.75. Component 3 also consisted of two items; ‘I find it easy to use the Internet’, loading =0.91, and ‘I find using the Internet difficult’, loading =0.85.

Table 5.6 Items and Loadings for Component 1

People who use the Internet are boring*	0.79
When I grow up I would like to use the Internet in my work	0.75
I hate using the Internet*	0.67
I enjoy using the Internet	0.66
I wish I never had to use the Internet*	0.65
People who use the Internet are fun to be with	0.46

*items reversed scored

5.6.4 Interpretation of the Components

The items for component 1 can be described as portraying an evaluative element of the perceived social desirability of an Internet user; a desire for Internet use by the self in the future, together with an affective response towards the Internet in relation to the self. This suggests that liking for the Internet, motivation to use by the self, and how Internet users as a group are perceived in terms of social desirability, have a relationship. In particular, the high loadings for ‘People who use the Internet are boring’ and ‘When I

grow up I would like to use the Internet in my work’, suggest that current perceptions of the social standing of others and future behavioural intentions are strongly related.

The items for component 1 were subjected to a reliability analysis using Cronbach’s alpha coefficient, which produced a result of 0.78 suggesting that the subscale is internally robust. The first two items show the heaviest loadings; therefore this factor was labelled ‘Desirability’.

The items for component 2 can be described as evaluative of an influence of the Internet on global well-being. The element these have in common is a sense of the universal impact of the Internet, external to the individual:

The world would be a better place without the Internet

The Internet will make the world a better place

Component 2 was labelled ‘Global’. The items for component two were subjected to a reliability analysis Cronbach’s alpha coefficient, which produced a result of .61 suggesting that the value of these items as a subscale is questionable.

The third component consisted of the following attitude statements:

I find it easy to use the Internet

I find using the Internet difficult (reversed scored)

These items reflect an attitude of the perceived ease with which the Internet can be used directly in relation to the self. This can be described as a measure of self-confidence, and labelled simply ‘Confidence’. The items for component 3 were subjected to a reliability analysis using Cronbach’s alpha coefficient, which produced a result of .78 suggesting that this subscale is internally robust.

5.6.5 Component Correlation Matrix

The correlation matrix for the mean scores of the three components revealed a statistically significant relationship between Desirability and Confidence ($r=0.43$,

n=109, $p<0.01$) and between Desirability and Global ($r=0.24$, n=109, $p<0.05$). There was a small, but statistically nonsignificant relationship, between Global and Confidence ($r=0.14$). This suggests that although there may be some aspects of the components indicative of a common underlying construct, such as that proposed by a construct of PAttI, there was unlikely to be a unique commonality at the core of all three components at this stage of the research.

5.7 Multivariate Analysis of Component Scores

A multivariate analysis was carried out to investigate potential effects and interactions relating to the independent variables of participants' gender, the presence of a computer at home and Internet at home (no computer, computer at home, computer and Internet at home), with the three scale components resulting from the principal components analyses. Three dependent variables were therefore used: mean score for Desirability components; mean score for Global components; and mean score for Confidence components.

Prior to carrying out the analysis, Mahalanobis distances were calculated, to check for outliers. All participants were within the upper and lower bounds. Box's test of equality of covariance matrices confirmed that the assumption of homogeneity of variance-covariance matrices was not violated. Levene's test of equality of error variances was not violated.

5.7.1 Multivariate Results

Gender was a statistically significant main effect, $F=6.38$; d.f.=3, 101, $p=0.001$; $\eta_p^2=0.16$. Computer and Internet presence at home narrowly missed significance, $p=0.052$. An interaction between gender and computer and Internet presence at home was significant, $F=2.16$; d.f.= 3, 101; $p=0.048$; $\eta_p^2=0.06$.

Examination of the univariates found that gender was significant for Desirability, $F=12.81$; $d.f.=1, 103$; $p=0.001$; $\eta_p^2=0.11$; Global, $F=4.32$; $d.f.=1, 103$; $p=0.04$; $\eta_p^2=0.04$; and Confidence, $F=11.30$; $d.f.=1, 103$; $p=0.001$; $\eta_p^2=0.10$. Examination of the mean scores for gender, shown in Table 5.7, found that the boys' scores for Desirability, Confidence and Global were all higher than the girls'.

Table 5.7 Gender and Individual Dependent Variable Scores

	Gender	Mean	Std. Error
Mean of Desirability Score	boys	4.07	0.08
	girls	3.60	0.10
Mean of Confidence Score	boys	3.48	0.12
	girls	3.09	0.15
Mean of Global Score	boys	3.64	0.11
	girls	3.02	0.15

Confidence was a significant univariate for Computer and Internet presence ($F=4.49$; $d.f.=2, 103$; $p=0.013$; $\eta_p^2=0.08$). Examination of the means, shown in Table 5.8, reveals that the highest scoring group for Confidence were the participants with both computer and Internet access at home.

Table 5.8 Computer/Internet Access: Confidence Score

Computer and Internet Access at Home	Mean	Std. Error
No computer	2.94	0.17
Computer - no Internet	3.49	0.10
Computer and Internet	3.55	0.20

The univariates for the interaction of gender and computer and Internet presence at home, showed a significant result for Confidence only, $F=4.75$; $d.f.= 2, 103$; $p=0.011$; $\eta_p^2=0.08$. Table 5.9 presents the mean scores for the interaction of Gender and Computer/Internet presence for confidence. Confidence scores were higher for the boys than the girls for all categories of Computer/Internet access. The girls' lowest mean score for Confidence was for those with no computer at home and the highest was for those with computer presence, but no Internet access, at home. For boys, the highest mean score was for boys with both Computer presence and Internet access at home. Boys with computer access, but no Internet, score marginally less for Confidence than those with no computer access.

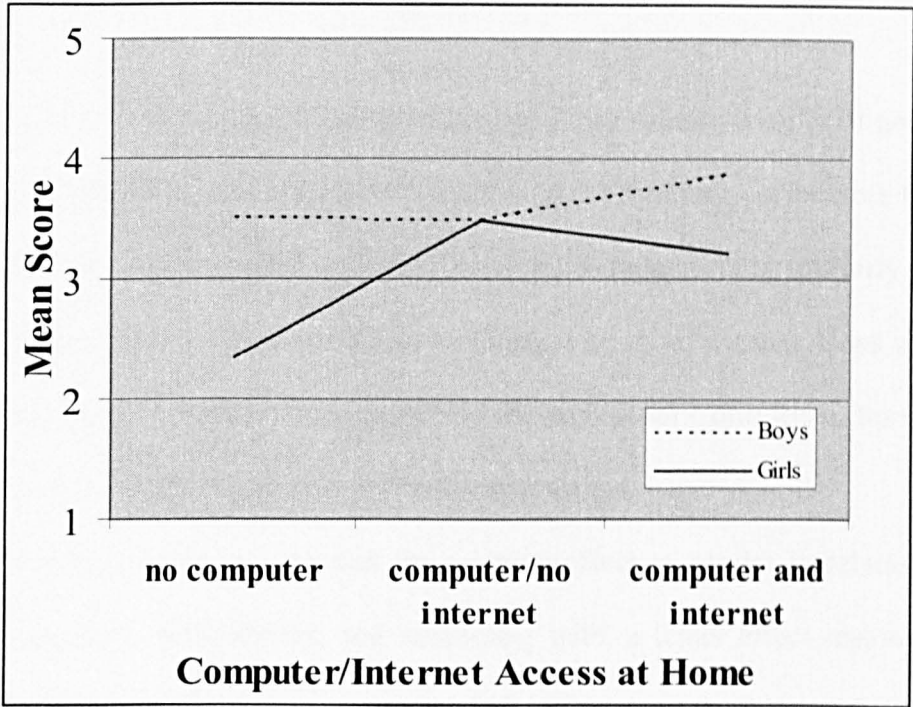
Table 5.9 Computer/Internet Access: Gender and Confidence Interaction Scores

Gender	Computer and Internet Access at Home	Mean	Std. Error
boys	no computer	3.52	0.16
	computer no Internet	3.50	0.14
	computer and Internet	3.89	0.26
girls	no computer	2.36	0.29
	computer no Internet	3.49	0.13
	computer and Internet	3.21	0.29

There was a negligible difference in Confidence scores between boys and girls with a computer presence at home. However, boys still scored higher than girls for Confidence where both groups do not have a computer at home and also where both groups have Computer presence and Internet access at home, as Figure 5.2 illustrates. This suggests that, regardless of a comparable lack of computer presence at home, boys still scored higher than girls for the dependent variable of Confidence. The addition of Internet

presence at home impacted differently between the sexes in this study, with boys' scores for Confidence increasing whilst the girls' scores decline.

Figure 5.2 Gender and Computer/Internet Presence: Interaction for Confidence Score



5.7.2 Summary of Multivariate Results

The relative effect sizes of these results suggest a large effect of Gender and a medium effect for the interaction between Gender and Computer and Internet Presence at Home.

For the independent variable of Gender, the boys' scores were higher than the girls' with 16%, a large effect size, of the variance attributable to this. Computer/Internet access narrowly missed significance. An interaction between the two independent variables was statistically significant with 6% of the variance attributable to this, a medium effect size.

Gender was statistically significant for all the individual dependent variables; a large effect size, 11% of variance was attributable to gender for Desirability, and 10% of

variance attributable for Confidence and a medium effect size for Global with 4% of variance attributable. The boys' scores were higher than the girls' for each of the dependent variables. Computer/Internet presence was statistically significant for Confidence, with 8% of the variance attributable to this component, a medium size effect. Boys with both computer and Internet presence at home scored the highest for confidence.

Looking next at the interaction between the two independent variables of gender and access, only Confidence was significant with 8% of the variance attributable to this, a medium effect size. Boys with a computer presence at home scored similarly to those without; whereas for the girls, Confidence was lowest for those without. Boys with both Internet and computer presence at home scored the highest for Confidence; for the girls, it was those with computer presence but no Internet access.

These results support an argument for a strong effect of gender in relation to the attitudinal measures, followed by, and interacting with, a lesser effect resulting from computer/Internet presence at home. Across all the dependent variables, girls had lower scores.

The girls in this study were negatively affected by the lack of computer presence in the home, relative to the boys, for Confidence. This suggests that the effect of computer presence or absence is more profound for girls than for boys in respect of the items contributing towards the Confidence component.

5.8 Gender Stereotypes of a Typical Internet User

In the final section of the questionnaire, participants were presented with the following statement:

Somebody is very interested in computers. This person spends a lot of time on the Internet, looking at interesting web pages, joining in chat rooms, sometimes playing

games, finding out information for homework, and emailing friends. What do you think this person looks like? Please do a quick drawing below or write a short description. This can be in any style you choose.

5.8.1 Analysis of the Stereotype Section

For analysis, the responses from this section of the questionnaire were separated from the main survey document and photocopied in order that the surrounding information, for example, the gender of the participant, could be omitted. Responses were given an identification number and an independent record made of the originator's gender. Of the 109 participants, six failed to respond to this section and were removed from further analysis.

The data was presented to five independent raters, three who held PhDs and two PhD students, who were required to sort them into three categories of either 'female person', 'male person', or 'neutral or ambiguous person'. The sorted responses were then entered into a spreadsheet record for each rater and the results analysed for inter-rater reliability. Figures 5.3, 5.4 and 5.5, are examples from each of the sorted categories.

Figure 5.3 Example of a Response Rated as a Female Person

Smart, has a
lot of friends,
and pen-friends,
has dark hair,
doesn't wear
glasses, neat,
has ears and
nose pierced



Female Person

Figure 5.4 Example of a Response Rated as a Male Person



Male Person

Figure 5.5 Example of a Response Rated as a Neutral or Ambiguous Person

- Quite intelligent
- Likes talking to other people
- ~~Knows a lot~~
- knows a lot about computers

Neutral or Ambiguous Person

Inter-rater agreement was analysed using Cohen's Kappa statistic (k) which assesses inter-rater agreement on categorical variables. Kappa was used to calculate the amount of agreement between the raters, in repeated rater x rater calculations, which were then averaged. The decision to place a response into a particular category was statistically significant between all raters ($p < 0.001$), producing an averaged kappa of 0.53. The range of kappa scores for individual raters with all other raters was from $k = 0.48$ to $k = 0.57$. Agreement level was interpreted using the guide provided by Landis & Koch (1977), which suggests that scores in this range have strength of agreement rated as 'moderate'. Examining the percentage of agreement for each item, the raters agreed 100% for 38 items 80% for 31 items, and 60% for the remaining 34 items.

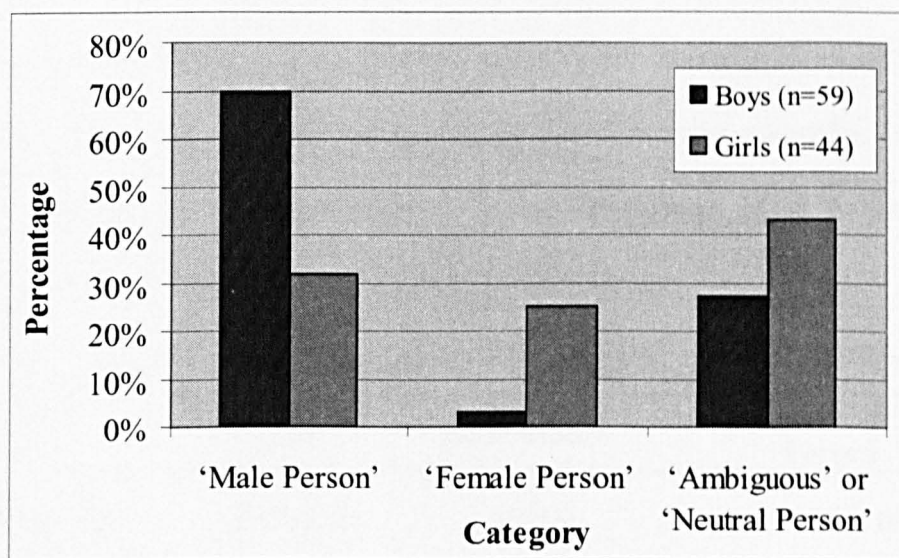
The mode was taken for each item of data across the raters and related back to original dataset. Thus, for example, if three or more out of five raters rated a response as 'female person' then this was taken as the overall result for the participant. The sorted responses were grouped according to the school year and sex of the participant. From this, it was possible to investigate relationships between the sex of the participant

and the perceived sex of the ‘typical Internet user’ by raters, using the chi-square test for independence.

Significant results were found for gender of participant, ($\chi^2=17.94$; d.f.=2; $p<0.01$). The boys were significantly more likely to portray a stereotype of an Internet user rated as a ‘male person’ (70%) with the remainder ‘ambiguous or neutral’. The girls’ most frequented rated category for stereotype of Internet user was ‘ambiguous or neutral’ (43%). This was followed by ‘male person’ (32%) with the remainder (25%) falling in the category of a ‘female person’.

The boys therefore demonstrated a stronger perception of a stereotype of the typical Internet user as a male person, relative to the girls, as illustrated in Figure 5.6. The girls were, however, were more likely to portray a stereotype indicative of an ambiguous or neutral person. Both sexes were least likely within their group to depict a response categorised as ‘female person’.

Figure 5.6 Relative Distributions of Internet User Stereotypes



The patterns of change relating to participants’ school year are of interest. The distributions of these responses are detailed in Tables 5.10 and 5.11.

Table 5.10 Distribution of Girls’ Internet Stereotypes across School Year Groups

Year	‘Male Person’	‘Female Person’	‘Ambiguous’ or ‘Neutral Person’
Year 8 (n=13)	31% (4)	38% (5)	31% (4)
Year 9 (n=15)	46% (7)	27% (4)	27% (4)
Year 10 (n=16)	19% (3)	12% (2)	69% (11)

Table 5.10 shows that in Year 8 the girls’ distribution of stereotypes was evenly distributed between the categories. In Year 9, there is a shift towards the ‘male person’ category. By Year 10, there is a major shift towards favouring the ‘ambiguous or neutral person’ category. Overall, a year on year decrease in the ‘female person’ category is evident.

Table 5.11 shows that for boys the category of ‘male person’ peaked at 75% in Year 8. Very small numbers portrayed stereotypes that could be considered of a ‘female person’. The slight dip in the ‘male person’ category was matched by an increase in the ‘ambiguous or neutral’ category in Year 9. To illustrate more pointedly, by Year 10, 71% of boys identified their own sex as being stereotypical of an Internet user, in contrast to only 12% of girls whom identified their own sex.

Table 5.11 Distribution of Boys’ Internet Stereotypes across Year Groups

Year	‘Male Person’	‘Female Person’	‘Ambiguous’ or ‘Neutral Person’
Year 8 (n=20)	75% (15)	5% (1)	20% (4)
Year 9 (n=22)	64% (14)	4% (1)	32% (7)
Year 10 (n=17)	71% (12)	0%	29% (5)

Even though there is a decline in strength for both sexes in respect of stereotypes relating to their own sex over the three-year period, for the boys the response remains significantly strong in comparison to the girls. This is highly suggestive of the male pupils' perception of the domain of the Internet as being masculine territory, whereas for the female pupils the perception is more ambiguous. However, it must be considered that these results indicate outcomes for particular cohorts of participants, who may not therefore have been subject to the same influences.

It had also been planned to analyse the responses according to whether they portrayed a negative or positive image. Unfortunately, this proved impossible to do with any degree of validity. For example, a portrayal may have attributes which are viewed by one person in a negative way, perhaps radical or rebellious characteristics, yet these may be a source of admiration for another person. The latent intention behind participants' responses to this section was too ambiguous for independent raters to categorise it meaningfully.

In summary, the boys in this study started from a high proportion, 75%, holding a strong perception of masculinity in regard to an Internet user. Even though this rigidity declined over the three years to 71%, it remained strong relative to the female participants. The girls' perception of an Internet user as belonging to their own sex declined substantially to 12%. Given that they start from a far lower starting point of 38%, this has potentially serious implications for continued participation by girls in an arena which it appears they do not perceive as relating to their own sex. The following section summarises and discusses the results of the investigative study.

5.9 Summary and Discussion

The objective of the survey study was to explore and develop a preliminary picture of the place and role of the Internet within adolescent school pupils' lives. From the

information gained it was anticipated that indicators would be generated about the possible relationship of gender with ICT and attitudes, in formal and informal contexts, together with information about the underlying factors contributing to the proposed construct of PAttI.

Gender and ICT were investigated and the emerging presence of the Internet in the lives of adolescent school pupils examined using a questionnaire. Firstly, access and attitudes within the broader context of ICT generally were looked at. Informal interactions with computers were considered. Finally, Internet use was focused upon, to explore whether it was emerging as a distinct medium in its own right in respect of boys' and girls' attitudes and appropriation of use; or whether the previous lack of girls' psychological access, evident from the literature review in respect of computers, would again be reproduced in this new field.

In consideration of access to computers, the girls' access was unexpectedly greater than the boys' in Years 8 and 9, though this was comparable by Year 10. In respect of access to other sophisticated media technology generally, there was a one-year difference between the boys and girls of the point at which ownership peaks, Year 8 for girls, Year 9 for boys. This may be attributable to a developmental effect, but could also arguably be due to a cohort effect. For example, the younger age group may be experiencing a greater and more positive exposure to the technology than the older groups; however, the sex difference at the point where ownership peaks is equally suggestive of a developmental influence. Given the previous relative lack of girls' access to computers demonstrated in the literature, it seems most probable that there is an interaction between the two factors.

With regard to computer activity generally, the most popular activity for all participants was 'games'. Since the market for computer games is still dominated by

software content primarily directed towards 'masculine' interest (Frenkel, 1990; Kirriemuir, Ceangal, & McFarlane, 2004), the perception of the preferred computer activity as involving a gendered activity may have implications in terms of the continued development and progression of girls' interest in computers.

The attitudinal section of the questionnaire presented 16 items, designed to probe areas of likely relationship to a construct of PAttI. These drew on gender stereotypes, beliefs, behaviours, intentions, and affective responses to the Internet, suggested by the literature and field study.

A reliability analysis showed the gendered items needed to be excluded from scaling of the items. The failure of these items to form a subset, or alternatively contribute to other subscales, was problematic. The element they all had in common was the use of 'Boys' or 'Girls' in the wording, for example 'Boys like the Internet less than girls'. It seems probable that this confounded the results, and a more indirect phrasing, which could then be related to the gender of the respondent, might have been more productive. It can therefore be argued that the outcome was indicative of an effect due to this particular component. This may have a relationship with the 'We can, I can't' paradox (Collis, 1985), perhaps confounding the potential relationship of items collectively, or in relation to other subscales. The remaining ten items showed a high level of internal reliability.

Principle components analysis revealed three dominant components. The first one, labelled 'Desirability', indicated attitudes which related to the participants' perceptions about future intent to use the Internet in relation to career, current use of the Internet as pleasurable or not, and Internet users as being boring or fun to be with. The second component labelled 'Global', consisted of primarily two attitudinal items relating to a proposition about the effect of the Internet upon global wellbeing. The final component

labelled 'Confidence' consisted of attitudes relating to the individual participants sense of confidence in use of the Internet.

Scale scores were calculated for the three identified factors of Desirability, Global and Confidence based upon individuals' mean scores for the items comprising each component. A multivariate analysis of these in relation to Gender and Computer/Internet presence in the Home, showed Gender to be statistically significant, with Computer/Internet presence narrowly missing significance, and a significant interaction between the two.

For the individual dependent variables, Gender was statistically significant for Desirability, Confidence and Global, and Computer/Internet presence for Confidence; there was also a statistically significant interaction between the two for Confidence. The presence or absence of a Computer/Internet access in the home impacted with a larger effect upon Confidence for the girls. Computer presence equalised the scores in respect of Confidence between the sexes. However, even when boys did not have computer presence in the home, they were just as confident as boys with a computer presence in the home; for the girls this was not the case. In other words, the boys had greater Confidence scores than the girls, regardless of whether there was a computer at home; whereas in the case of the girls, the presence of a computer at home was an important positive variable for their Confidence scores. In addition, whereas boys with Internet access showed a further increase for Confidence, the girls showed a relative decline. The possible reasons for this are not readily apparent.

The final section of the survey questionnaire produced evidence that gender stereotypes were present, with boys holding strong perceptions about the typical Internet user as male. This supports findings from previous research relating to computer users (Brosnan, 1999). Most striking from the study is the indication in this

study that girls are not identifying the use of the Internet with female stereotypes or potential positive role models relating to their own sex. This suggests that although the Internet offers a radically new aspect to Information Technology, in terms of interactivity and communication, which it can be argued may have more in common with feminine dialogue and knowledge construction, there remains a risk that full psychological access to the medium will remain inequitable between the sexes. This may impact upon the willingness of female pupils to voluntarily interact with the Internet.

Previous literature has indicated active exclusion strategies of boys in respect of ICT, for example Millard (1997). The results from this investigative study are suggestive therefore of reasons for concern; exclusion strategies may be reproduced in relation to Internet activities. Not necessarily by overt exclusion, but, for example, by the social and cultural portrayal of the appropriateness of participation by girls, and the lack of software provision recognising 'feminine' areas of interest. However, despite this, there was some evidence of the younger girls in this study using the ICT to support their own areas of interest, such as the communicative aspects of the Internet and information seeking which they find of personal relevance to them. It is perhaps these informal routes to computer and Internet participation, confidence and motivation, which will prove to be the critical factor in accessing more formal applications of the medium in educational environments on an equitable basis.

The investigative study described in this chapter suggested that the following aspects were indicative of, and relevant to, PAttI, providing key issues to be focused upon in developing a further conceptualisation of the construct. It is argued that the underlying contributors towards a construct of PAttI might be found in these areas. Firstly, perceptions of individual enjoyment, utility, and relevance of the Internet

needed to be examined and secondly, intention to use the Internet. Further research also needed to take into consideration the informal aspects of access, in terms of choice, exclusion, and areas of activity being appropriated by the sexes. Finally, consideration of developmental issues, gender stereotyping, the social impact and context of Internet use, are argued to be of importance.

The interview study which follows in the next chapter sought therefore to explore further some of the issues raised by the survey, through conducting semi-structured interviews in the following areas of potential interest:

- **Informal uses of computers:** applications, frequency, where and with whom
- **Use of Internet:** context, formal use, voluntary use: type/frequency, liking of.
- **Attitudes towards the Internet:** perceived future importance: individually/globally, perceived enjoyment, usefulness, and, intention to use.

The next stage of the research was intended to offer further triangulation of data and move towards an evidence-based construct of PAttI with a well-grounded instrument with which to measure it.

CHAPTER SIX

6 INTERVIEW STUDY OF GIRLS' AND BOYS' ATTITUDES AND USES OF ICT

6.1 Introduction

The interview study described in this chapter was designed to explore in more depth the key themes and issues which emerged from the investigation described in Chapter 5. A selection of 30 from the original 109 participants was interviewed, concentrating on matters of perception, use, and intent to use, computers and more specifically, the Internet.

6.2 Focus of the Interview Study

Following on from the investigative survey it was possible to identify several key areas which would benefit from further investigation using interview methodology. The interviews with pupils were based upon an open-ended schedule relating to these key areas, as outlined below:

Informal uses of computer

Type, duration, who with, where

Games – favourites, dislikes

Ownership of a dedicated games machine; the difference between this and ownership of a personal computer was made explicit by the interviewer

Uses of Internet

What they have used the Internet for in formal / informal situations (for example lessons/lunchtime/home)

Which aspects they liked/disliked

Voluntary uses of the Internet; type, duration

Attitudes to the Internet

If they thought the Internet would be important in the future, to them specifically
and also generally

Perception of fun and use of the Internet

Perceived usefulness of the Internet

What they would like to use the Internet for

6.3 Participants

The majority of the interviewees were from the secondary school population who had participated in the investigative study and had indicated on their returned questionnaire that they would be willing to take part in further research.

Thirty interviewees participated, 15 boys and 15 girls aged 12-15 from Years 8, 9 and 10. These were all of the volunteers from the investigative questionnaire, plus five Year 10 girls, aged 14-15. This particular sub-group was approached directly, by approaching them at random within classes known to have participated in completion of the questionnaire, and invited to participate in the interview study. There were no initial volunteers from this sub-group resulting from the original questionnaire. It proved impossible to ascertain the reasons why no girls volunteered from Year 10. It can be speculated that this in itself could be a reflection of a girls' disengagement from ICT during adolescence; however, there was a lack of direct evidence available at the time to support this view. Table 6.1 illustrates the distribution of girls and boys across the school years.

Table 6.1 Interviewees

	Year 8	Year 9	Year 10
Boys	5	4	6
Girls	6	4	5

6.4 Interview Procedure

Interviews were conducted on a one-to-one basis in a quiet room on school premises and took approximately 20 minutes. The interviewer introduced herself by her first name and said she was from the Open University, carrying out research. Dress and manner were deliberately informal in order to be distinguished from teaching staff and inspectorate visitors, hopefully engaging the students in a relaxed and informative interview.

The interviewees were reminded of the questionnaire they had completed previously and also told that the interview was voluntary and they could withdraw at any time if they wished. They were asked for their consent for the interviews to be tape-recorded for the accuracy of information gathering. They were advised that only the interviewer would have access to the tapes and further assured of the anonymity of their comments, which would not be attributable to them as individuals. They were given the opportunity to withdraw at any stage.

The actual interview schedule (6.2) was varied in terms of order and depth according to the direction taken within individual interviews.

At the end of each session, interviewees were asked to complete a short questionnaire (Appendix B) which detailed relevant demographics and background information. They were asked not to discuss the contents of the interview with the other students, to avoid a possible influence upon interviews yet to take place. The

interviewees were then invited to ask any final questions they may have. Only two interviewees chose to do so; one to ask more about the research and the other about a technical problem they were having with their computer.

6.5 Interview Analysis

The audio-taped interviews were transcribed in full by the interviewer shortly after they were carried out. The transcripts were then subject to close examination, firstly by a complete read-through of all the texts, and then by random selection of all the individual texts, with notes being made towards a rough coding protocol of meaningful categories arising from recurrent themes across the interviews. The coding protocol was then used to code each individual transcript. Some extracts had more than one code attached when the information was not exclusive. The coded sections from transcripts were then 'cut and pasted' into a tabular document according to their overarching theme and further categorised by gender. This enabled the extracts to be readily examined and compared between the sexes in a process of thematic analysis, the results of which are presented in subsection 6.8.

This data provided triangulation for the observational and survey information gained during the exploratory and investigative studies and offered an enriched picture of the possible key contributors towards a construct of PAttI.

6.6 Results of Background Data

The following subsections present the results of data obtained from the post-interview questionnaire (Appendix B). Responses were coded and entered into a SPSS data file and then subjected to analysis for appropriate descriptive statistics.

6.6.1 Computer in the Home - Access

The first aspect to be examined in this study was the actual degree of physical access to a computer in the home. This was established by finding out the following information:

Whether there was a computer in the home

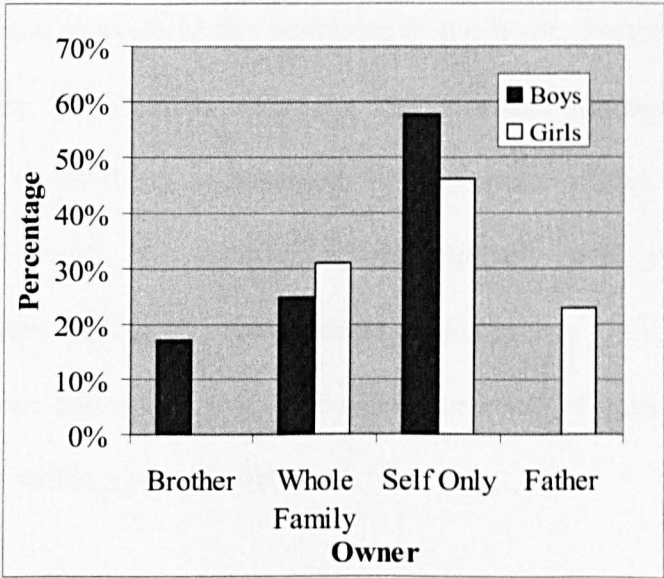
Who was perceived to be the owner

Who was perceived to be the main user

The location of the computer within the home

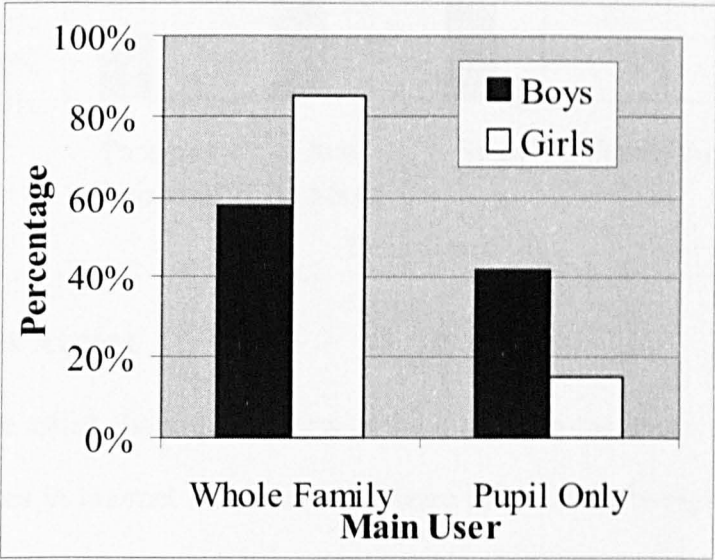
For the majority of participants there was a computer at home. Thirteen girls and 12 boys came from a home with a computer. In response to the open question, ‘who does it belong to’, no participant perceived their mother as owner of the computer, or a sister. Figure 6.1 illustrates the relative distributions between the sexes in terms of who was actually perceived to be the owner. For both sexes the most frequent category of ownership perception was the student themselves.

Figure 6.1 Ownership of Computer in Interviewees’ Homes



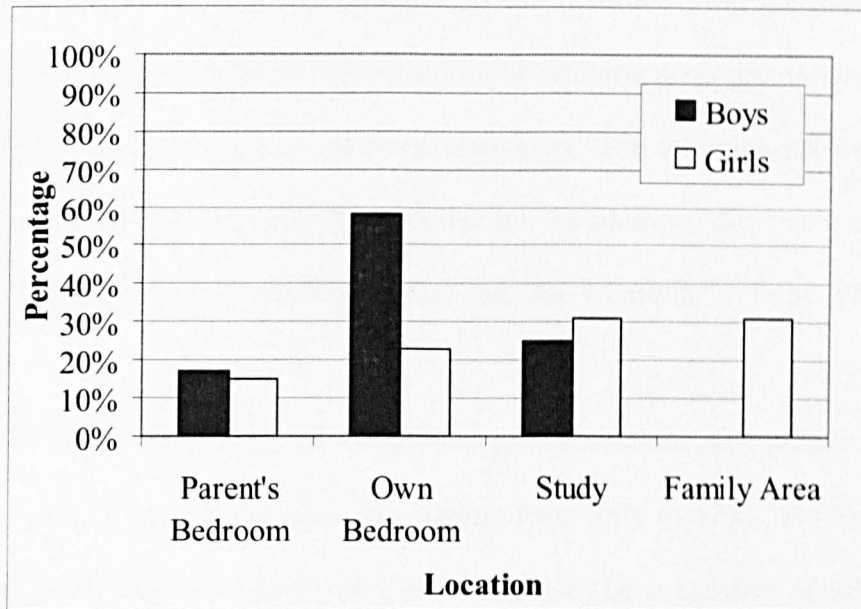
The participants were also asked who the main user of the computer was; Figure 6.2 illustrates the results. The most popular category across all years was the ‘whole family’, although proportionally far more boys identified themselves as the main user than girls.

Figure 6.2 Main Computer Users



Turning to the actual location of the computer in the home, Figure 6.3 illustrates the distributions by sex. For the boys, their own bedroom was the most popular category (58%). A quarter of all the boys accessed their computer within a dedicated study. Within the girls’ sample, the distribution was relatively more evenly spread. The computer was equally present in either a study or family area (31%), closely followed by the student’s own bedroom (23%). A similar proportion of boys and girls accessed the computer from within a parent’s bedroom.

Figure 6.3 Location of Computer in Interviewees' Homes



6.6.2 Internet Access

Participants were asked about their access to the Internet in the home. Across all years, gender differences in Internet access at home were minimal. Fifty-eight per cent of the boys ($n=8$) and 47% of the girls ($n=7$) had Internet access.

6.6.3 Summary of Physical Access

In summary, the computer was most likely to be perceived as being 'owned' by the participant. However, in terms of use, the whole family was considered overall to be the 'main user'. Internet access was very similar between the sexes. With regard to the actual location of the computer, boys were more likely to have a computer in their own bedroom, whereas for the girls, the location was distributed relatively equally between a family room or study, and their own bedroom.

6.7 Dedicated Games Machine Ownership

One of the sources of potentially misleading data identified from the literature review was a tendency for researchers to ask questions about computers generically, rather than clearly specifying differences in types of computers. The interviewees were therefore specifically asked to state their type of computer. In addition, they were asked if they also had dedicated games machines, such as, for example, a Sony Playstation or Nintendo.

Across all years ownership of a dedicated games machine was greater for boys, as shown in Table 6.2, with a gender gap ranging from 25% to 47% . For both boys and girls the year of greatest ownership is Year 8. This may be suggestive of a cohort effect. However, it is also notable that there is a progressive decline across years for girls from Year 8 to Year 10. A far larger sample would be required to investigate this aspect further. The next section presents the outcomes of the interview analyses.

Table 6.2 Interviewees Ownership of a Dedicated Games Machine

Year 8 Girls	Year 8 Boys	Year 9 Girls	Year 9 boys	Year 10 Girls	Year 10 Boys
50%	80%	25%	50%	20%	67%

6.8 The Interviews

Analysis of the transcribed interviews resulted in the following key themes being identified:

- Capabilities, Confidence and Risk Taking
- Effect of Situational Context
- Boys' Domination of Facilities
- Perceptions of Valid Computer Use
- World Wide Web Choices

- Future Work Intentions and the Internet
- Future Voluntary Use of the Internet

Details of the findings which arose from these themed categories are given in the following subsections, with illustrative extracts from the interviews quoted.

6.8.1 Capabilities, Confidence and Risk Taking

Interviewees were asked whether they had observed differences between individuals in their approach to computers and the Internet. Many of the responses were indicative of stereotypes in perceived gender differences. The boys' perception of girls' use of computers and the Internet was weighted heavily towards negative comments. Girls were seen not only as less capable:

Lots of girls in my IT class don't seem to understand the very simple things, the amount of times it's like been explained to them and they don't get it' [boy Year 10]

They just don't seem to know what they're doing really' [boy Year 10]

but also as lacking in confidence,

They just get Sir to help them' [boy Year 9]

Some of the girls' comments echoed this perspective,

I think the boys have a better knowledge than the girls on computers, I don't know why. But a lot of the boys have more confidence on the Internet things; whereas I'm not very good at finding things (...) I think they're more encouraged to. Possibly they've got more [computers] at home (...) I know that it's the boys that mostly use them (girl Year 10)

Another area of comment upon gender differences by interviewees reflected greater risk-taking behaviours by boys, especially willingness to take 'risks' in acquiring computing skills. This has obvious overlaps with capabilities and confidence but these extracts show a slight difference in emphasis:

They're pretty scared of them aren't they, I mean, they treat them like something might go wrong...whatever happens they think they've done something wrong! [...]
I was never afraid, I mean I just did it! Yeah the computer did get wrecked, once or twice' [boy Year 9]

The boys don't seem to be nervous about them [computers], they just fiddle around and if it goes wrong it goes wrong! The girls just sit there and say 'what do you do? I don't know, I don't know what to do! [girl Year 10]

The boys tend to be slightly more confident than the girls and slightly more risky as well. They take the risk, if something's gone wrong they try to sort it out themselves.' [boy Year 10]

People seem to get nervous about them (computers) I don't know why. Well, I know, because I've been nervous about them before, you're scared if you do something wrong it's going to blow up! [...] if they're not mine I get scared of damaging it and if it's all going to go wrong and I'm going to get the blame for it, yeah. I get really nervous about that [...] or if the teacher don't explain it properly, what you're doing, you're like 'I don't know what to do!' [girl Year 10]

There appears to be a situation wherein not only is girls' interest and confidence with computers seen as less than that held by boys, but also a concurrent fear of risk taking with the equipment in the school environment. Perceived differences are further demonstrated by female interviewees' comments upon the boys' view of their choices of use, showing an awareness of their choice of use being belittled:

I just chat [online] usually, he doesn't usually use it for chatting though, he says he thinks it's stupid.' [girl Year 10 talking about her brother]

6.8.2 Effect of Situational Context

Context may be an important issue here, for example the school environment. One Year 10 girl spoke about her relative confidence in the familiar home environment versus her anxiety in school:

Personally I think that when I'm at home I'm more confident with using my own computer than at school, 'cos I feel like I know, I know my computer, I know how to do everything on it whereas at school I sort of hesitate I think, thinking, you know, I don't want to do anything wrong!'

Consequently we have a situation in which participation is directly influenced by the environmental context. Indeed, when a girl is seen as displaying computer confidence and literacy, she becomes particularly salient:

Some of them know more than the boys, especially one in our class, knows a lot more [boy Year 9]

This is a factor relating to extra attendance to unusual happenings in the environment, indicated in previous literature (Rojahn & Pettigrew, 1992). Thus, in an environment where an overt ability with computers is seen to be an unusual characteristic in girls, the

stereotype held becomes a base marker against which such ability is disproportionately measured.

6.8.3 Boys' Domination of Facilities

There was also a perception held by the girls of boys' dominance of facilities. For example, a Year 10 girl talked about lunchtime access to a dedicated IT room in which students had free access to computers including the Internet:

There's a lot more boys that go on it because when I come up at lunchtime most of the time that room there's totally full up so [...] usually all boys [...] the boys come up like don't eat their lunch and they race up the stairs to get on them [...] you have to wait for ages.

It is interesting to highlight a boy's perception of the same facility and its usage by the girls:

They seem not that bothered about using the Internet and stuff, they don't normally come and use it, whereas in the lunchtime when we come up here like, there's maybe one or two, but the rest of them are boys like ten boys to one girl, they don't seem to use it as much. [boy Year 10]

6.8.4 Perceptions of Valid Computer Use

Another girl, Year 10, adds a further interesting perspective on the lunchtime facility. When asked if she used the ICT lunchtime access, she replied:

No! that's my relaxing time.

This illustrates an attitude of the facility as one to be related to pragmatic use rather than a 'fun' or leisure activity. The gendered nature of interest and voluntary activity in information technology was further indicated by the girls interviewed:

I reckon sometimes that while the girls are out shopping they're [boys] probably sitting at home behind their computers. [girl Year 10]

Boys use most likely the games more, but the girls use the computer as in typing for school work and stuff more than boys do. [girl Year 8]

I don't think the girls really see computers as a pastime [...] possibly why they're not so involved in it. I suppose when the girls are out you know with their friends or whatever, some boys are on the computer and stuff. [girl Year 10]

Girls were also perceived by some of the boys as lacking in an intrinsic interest in computers:

Usually boys, their main topics like football and computing games and girls have their own little topic, I don't know what they talk about but it's not computers and stuff so maybe if they got more into computers and that they might enjoy it and use it more. [boy Year 10]

Girls don't really play as much on their computers (...) they mainly use them for homework or just schoolwork and stuff. [boy Year 10]

They're just not usually into computers full stop really, are they? They just don't like games or anything. [boy Year 10]

These responses are indicative of beliefs that the girls are not interested in computers or the Internet and of a perception of boys' domination of resources. These negative appraisals find support in previous literature in which boys' confidence in specific domains seems to be at the cost of girls' participation. The question is whether girls are pushed out, or whether they opt out.

6.8.5 World Wide Web Choices

When asked if he thought that the ways in which he had described current computer use between the sexes as being 'games for boys, homework for girls' would prove to be similar for the Internet, a boy [Year 9] replied:

No ... because there's stuff that girls could look up like, erm, I don't really know what girls would look up!

A difference between the boys and girls in areas of website interest is a theme picked up on by several interviewees:

The boys mainly look at different things to girls, like probably boys usually go to all the sports stuff and that [...] girls go to clothes and all that really. [boy Year 8]

Some of them [girls] go to sports but most of them go to like, what's on TV and clothes and fashion and that. [girl Year 8]

These aspects of Internet use may be an early indication of an appropriation of the Internet to support areas of informal interests for both sexes. This will perhaps circumvent prior gender biases in the areas of computer confidence, motivation and intent to participate at various levels, including formal applications of computing.

It has been suggested from the research literature that prior experience with ICT reduces the gender differences in confidence which are detrimental to girls. The difficulty however, is that even when policies of equal access and educational provision have been addressed, the 'opt-out' factor - when pupils are given a choice of participation - has not been considered. The possible implications of this should alert us to the serious consequences that could be anticipated in adults' social and working lives.

6.8.6 Future Work Intentions and the Internet

When asked about future work intentions involving computers and the Internet, 11 boys (73%) and 9 girls (60%) envisaged the likelihood of using such technology in their future working lives. This indicates a moderate level of awareness of the potential relevance and ubiquitous nature of ICT in work environments in the UK.

6.8.7 Future Voluntary Use of the Internet

In order to pursue the probability of voluntary future usage, interviewees were asked to imagine they had Internet access in their own home and it was like the USA, in that the calls were either free or very cheap. At the time of the interviews in 1999, Internet access was still a relatively expensive commodity and a source of concern to parents regarding telephone bills. The interviewees were then asked what they would like to use the Internet for. Table 6.3 details the categories generated from the responses.

Table 6.3 Future Internet Use Intentions

Area	Boys	Girls
Chat	3	2
Email	1	1
Research/homework	1	3
Games downloading	2	0
Leisure information	2	3
Shopping	0	2

A survey of a larger sample would be necessary to gain more information here. However, these preliminary indicators indicated some useful areas to explore in terms of how the sexes are using the Internet to support their own interests and needs. For example, when participants were asked how they like to spend leisure time, aside from possible computer or games machine play, the most popular leisure activity for the boys was sport-related activity such as 'playing football with mates'. For the girls 'shopping/hanging round the shops' was frequently mentioned.

The interview evidence suggests a similar level between the sexes of voluntary intent to use the Internet in their lives but also a possible gendered appropriation of the type of use. Overall, enthusiasm of both boys and girls for using the Internet in their future lives was apparent.

The factors impacting upon a positive and voluntary interaction with computing facilities, especially within an educational environment, did however appear to be influenced by gender. This can be described as a product of a lack of PAttI, which it can be argued results from a process of gender stereotyping and attitude development impacting differently upon boys and girls. The debate however, also needs to now address the question of whether a gendered appropriation of the Internet medium is becoming evident in informal environments; and what the implications of this may be for equal participation in education. This is addressed in the main study.

6.9 Discussion and Conclusions

The interview study was concerned with further exploring issues implicated by the exploratory and investigative studies, relating to gender and matters of perception, use, and intent to use, computers; and more specifically, the Internet, particularly in voluntary contexts. The evidence suggested several relevant issues:

- Boys' negative perceptions of girls' interest, confidence and ability with computers and the Internet
- Girls' perceptions of boys' domination of access to facilities
- Suggestions that girls are appropriating the Internet to support their own needs and interests
- Differences in motivation to use the Internet and the type of Internet use
- The impact of situational context upon girls

The latter three findings particularly provided new avenues to further explore the question of whether previously observed inequities of gender relating to computers generally, would also be evident in Internet use.

Boys' confidence and competence with computers has at least, in part, been attributed previously to computer gaming and perceptions of appropriate masculine roles. The Internet, arguably having more in common with feminine approaches to knowledge seeking and construction may prove to overcome prior inhibitions of girls towards computers generally, with positive implications for full participation.

It was encouraging to see that the girls in this study showed signs of exploring the medium in a voluntary context. It is this route that may, as with boys' use of computer games, provide them with the necessary psychological access to the medium in more formal contexts, such as education.

Already, the economic market place of 2000 was acknowledging the need for women's participation with the Internet. The commercial potential for advertisers on the Internet was being widened to include scope for targeting 'feminine' interests, for example. This is no strategy of altruistic inclusiveness, but one being driven by business pragmatism. Indeed, some studies (Cyberatlas, 1998) were predicting that female users online would soon outnumber male users.

Media Metrix (AdRelevance.com, 2000) produced statistics to show that sites attracting women were a reflection of trends in real life shopping and individual interests. For example, kbkids.com, a toy shopping site, comprised 73% women users and espn.com, a baseball site, only 27% women users. Nearly 90% of women stated that they were the decision maker for healthcare issues. Advertisers were therefore beginning to target specific products to sites popular with women in response to surveys which indicated that, for example, women are responsible for 80% of purchasing decisions (Cyberatlas, 1998).

The above information illustrates the increasing participation and targeting of women users around the time of the interview study. It can be argued that this evidence of voluntary female Internet users' appropriation of the medium to support their needs and interests will indeed provide psychological access to the Internet, increasing experience and confidence. Thus, voluntary usage in this sphere may well do for women what computer gaming is said to have done for men. However, reservations need to be voiced in respect of two crucial factors. Firstly the counterproductive element of gender stereotyping which is still evident in participants' perceptions of capabilities; and secondly situational influences which may detract from women 'opting in' to environments which they find discouraging, for example a negative impact of some contexts upon attitudes such as confidence.

What primarily emerged from the interview study was the need to research further into the impact of gender upon psychological access to the Internet; the choice to use and appropriate the medium according to individual need and desire in voluntary contexts; and the relevance and importance of this in formal environments such as schools.

The literature review, exploratory, investigative and interview studies each contributed towards the further conceptualisation of PAttI, the psychological construct proposed in this thesis. From an initial, broadly based definition in Chapter 1, in which it was put forward that individuals' attitudes have a significant role in influencing their voluntary participation in the use of ICT, these studies have highlighted significant features contributing towards an overall construct of PAttI. They have also shown that it is important to direct measures of PAttI towards the individual, rather than presenting global 'what if' scenarios, or directly gendered stimulus statements. Whilst girls may show a positive reaction to a universal gendered stimulus in relation to ICT, when the stimulus is directly addressed to themselves as an individual, contradictions emerge. This has been noted previously in the literature (Collis, 1985).

To summarise, the exploratory, investigative and interview studies indicated that the following facets should be considered as important aspects of the PAttI construct:

Future Self: *The perception of the Internet in relation to a concept of a 'future' self in respect of intent to work with ICT and to have Internet access in a future home.*

This is proposed as indicative of individuals' behavioural intentions, as reflected in their current attitudes towards the Internet, by capturing a notion of personal relevance in respect of future professional and domestic lives. It is argued that current motivation and desire to interact with computers, and in particular ways (for example, Frenkel, 1990; Hennessy, 1999; Levin, 1989; Millard, 1997; Siann et al.,

1990), will be influenced by individuals' perception of their 'future self', thus contributing towards their overall psychological access to the Internet.

Social Self: *A perception of the Internet by an individual in relation to notions of friendship and social desirability.* This facet is proposed as capturing individuals' sense of the relationship and importance of the Internet with their own sense of personal social relevance and standing. The impact of stereotyping appears to be particularly salient here (Archer & Macrae, 1991; Beyer, Rynes, Chavez, Hay, & Perrault, 2002; Colley & Comber, 2003; Collis, 1985; Durmell, Glissov, & Siann, 1990; Kiesler, Sproull, & Eccles, 1985; Tan, 1985; Turkle, 1984; Williams and Ogletree, 1992). The facet therefore endeavours to capture this aspect indirectly, by drawing out individuals' collective inferences made about their social network and the Internet. It is argued that the degree of relationship between these will be indicated in the attitudinal responses; these could be equally negative or positive. A positive response however would be indicative of a greater degree of psychological access.

Confident Self: *Individual's sense of confidence in using the Internet, perceptions of own ability, and ease of use.* Much of the research literature has indicated the importance of confidence in respect of attitudes towards computers (for example, Collis, 1985; King, Bond, & Blandford, 2002; Makaris, 1993; Shashanni, 1993, 1994a, 1994b, 1997; Todman, 2002; Colley and Comber, 2003). This facet is therefore intended to encapsulate those elements attributed to a personal sense of confidence when interacting with the Internet.

Reactive Self: *An individual's motivation, interest, and inclination towards Internet use and sense of personal Internet safety.* The association of specific experiences with an internal affective response, such as feelings, emotion and mood, has been described in the tripartite model of attitudes, for example Breckler, 1984. The impact upon attitudes of affective responses towards computers is indicated in the research literature (for example, Brosnan, 1998a, 1998b; Comber et al., 1997; Jackson et al., 2001; Okebukola, 1993). This facet therefore focuses upon individuals' affective responses to the Internet, designed to capture the relative impact of these as reflected in measures of anxiety, wellbeing, interest, and liking for the Internet.

The model of PAttI has developed from merely suggesting that attitudes are the key factor in voluntary use of the Internet, and therefore productive of gains in experience and confidence, towards the development of a conceptualisation of what those attitudes are and their contribution towards the construct.

The next chapter sets out the main study. Following the exploration of the aspects contributing towards a construct of PAttI, and potential measures for this, the main study attempts to investigate this further amongst adolescent children in informal contexts at home and school.

CHAPTER SEVEN

7 MAIN STUDY

7.1 Introduction

The conceptualisation and development of PAttI, reported over the preceding chapters concluded that the facets of ‘future self’, ‘social self’, ‘confident self’ and ‘reactive self’ were identifiable as key aspects of the construct. Observation, survey, and interview methodologies were used to discover and measure these in relation to gender, access and use of the Internet.

Previous research as indicated in Chapter 2, suggests that there is a relationship between experience with ICT and confidence with ICT. Although mere provision on a surface level may appear to provide equity of access between the sexes, in practice it may not prove, of its own accord, to be sufficient. The provision of physical access to the Internet in school contexts, for example, as a matter of policy, does not necessarily equate to actual equitable outcomes between the sexes.

The psychological construct of PAttI proposed by this thesis is argued to be an important factor in the take-up of provision for voluntary informal access to the Internet. Without the internal motivation, opportunity, and encouragement of individuals to voluntarily engage with ICT, those crucial gains in confidence and experience will not occur. Moreover, this thesis argues that an account of voluntary take-up as merely relating to aspects of confidence would be overly simplistic; a spectrum of attitudes is proposed to be influencing individuals’ behavioural choices.

The main study presented in this chapter sought to investigate and measure the concept of PAttI in both informal home and school contexts where Internet use was voluntary, developing further a detailed conceptualisation of the model and testing a measurement scale grounded in the preceding research reported within this thesis.

The questions to be addressed in the final study were firstly those relating to actual behaviours potentially linked to PAttI:

- Is gender an important variable in the take-up of the Internet in informal contexts?
- Is gender an important variable in the type of use of the Internet in informal contexts?
- Is gender an important variable in the extent of use of the Internet in informal contexts?

and secondly, questions to draw out the inferred attitudinal aspects indicative of PAttI:

- Is there an effect of gender on a measure of PAttI?
- Is there an effect of context on a measure of PAttI?
- Is there an effect of experience on a measure of PAttI?

7.2 Design

The study reported in this chapter concentrates upon Year 10 children. This group was selected in order that a focus could be directed at an age (14-15 years) ostensibly sensitive to PAttI and particularly vulnerable to potential outcomes in terms of educational choices and social participation with ICT. It also enabled the levels of possible interaction, such as developmental issues and cohort differences between years, to be narrowed.

Children's access and use of the Internet in voluntary situations, at both school and at home, were surveyed and an attitudinal scale tested as a proposed measure of inferred aspects of PAttI. The relationships between gender, Internet use, and the measurement of PAttI, were explored. The effect of the schools' ICT policies in respect of permitting Internet access outside timetabled lessons was also explored in relation to gender and measures of PAttI.

7.3 The Schools

Four secondary schools took part in the study. All four schools were drawn from the same Local Educational Authority and were part of a Wide Area Network, namely a network or system of networks that connects computers and computer users over a wide geographic area of Internet connectivity. In order to preserve anonymity the schools were identified by an assigned colour: White, Yellow, Blue or Orange. Some of the participants from Blue school had also contributed to the exploratory, investigative and interview studies.

Two of these schools, Blue and Orange, were defined for the purposes of this study as ICT-rich; they had an explicit policy of voluntary informal out-of-lessons Internet access for all students, for example during lunch breaks or after school. The other two schools, White and Yellow were defined as ICT-poor, having no student access to the Internet outside lessons. This definition does not seek to portray standards of teaching and ICT provision generally, but merely to differentiate between school policies in respect of informal provision.

7.3.1 Orange School (ICT-rich)

Students in this school had informal access to the Internet. Around 1300 students attended the school, which was a co-educational foundation comprehensive school for students aged 12-18, drawing from a relatively affluent catchment area. The school was a specialist Technology College. Specialist schools in England belong to a government programme designed to encourage secondary schools to specialise in specific areas, for example Modern Languages or Music, to improve achievement. Around two thirds of secondary schools in England are specialist schools and eventually it is envisaged that all English schools will specialise. Additional funding each year through private and government funds is a key benefit, and this is often spent on ICT facilities.

The Office for Standards in Education (Ofsted) inspection of Orange school reported that standards in ICT were good and work enhanced through good access to high quality ICT facilities, with some pupils being 'fast tracked' for early examination entry. Ofsted is a non-ministerial United Kingdom government department, responsible for inspecting schools in the United Kingdom, and it reports on their strength and weaknesses (Ofsted, 2005).

7.3.2 Blue School (ICT-rich)

Students at this school had informal access to the Internet. Around 1100 students attended the school, a co-educational foundation comprehensive school for students aged 12-19. The school was a specialist Modern Foreign Language school, with a broad social mix of students. Ofsted inspection reported that skills in ICT were below average, with students making insufficient use of computers to develop their work.

7.3.3 White School (ICT-poor)

Students at this school did not have informal access to the Internet. Around 1700 pupils attended the school, which was a county mixed comprehensive for students aged 12-18. Although the students came from a variety of backgrounds, the overall socio-economic background was relatively advantaged. Ofsted inspection reported that no examination entries were made for ICT at GCSE or A level, but skill acquisition was considered good, with many students demonstrating confidence and national expectations being met.

7.3.4 Yellow School (ICT-poor)

Students in this school did not have informal access to the Internet. Around 2,500 students attended the school, which was a community school providing comprehensive education for students aged 12-18 and had Arts College status. The students came from

a wide range of social and economic background. Ofsted inspection reported that levels of achievement in ICT were below national expectations.

7.3.5 The Sample

The participants for the main study were drawn from Year 10 across the four participating schools. In schools Blue, White and Orange, the whole year 10 population was surveyed. In Yellow school, the sample size was 50%. Yellow school was exceptionally large and assigned the year group on an unsystematic basis to four house groups. In order to gain access to pupils and reduce the potential disruption to lessons agreement was reached that half of the year group, two house groups, would be surveyed.

7.4 The Survey Instrument

To explore the potential relationship of PAttI with gender, Internet use and attitudes, amongst the sample of adolescent schoolchildren drawn from the four schools, a survey instrument using a paper-based questionnaire was designed. Two versions of the questionnaire were produced (see Appendices C and D). Questions relating to informal ICT access outside of lessons were included for the ICT-rich schools (Appendix D) and omitted for the ICT-poor schools (Appendix C), since the scenario did not apply in the case of the latter. A survey was selected as the most appropriate methodology to collect a large amount of data across a cohort of adolescent children, enabling a robust sample for statistical analyses to be carried out and the construct of PAttI to be measured.

The questionnaire for the main study was designed by drawing upon the results of the preceding studies. It comprised a combination of categorical questions plus a proposed PAttI measure of attitudes. The categorical questions were primarily concerned with providing the independent variables against which the PAttI measure

could be examined for relationships. The survey document, detailed in the following sections, was designed to elicit both observable and inferred aspects of PAttI.

7.4.1 Introduction

The introductory section of the questionnaire advised the participants of the following:

This questionnaire is part of a research project on the Internet. Please complete it carefully on your own using a black or blue biro. There are no right or wrong answers and you do not have to be an Internet user in order to take part. It is anonymous, we do not need to know your name but we would like to know if you are male or female, so please put a cross in the appropriate box.

7.4.2 Section 1

This section collected categorical data on the degree and type of voluntary access reported by individuals at the ICT-rich schools only; that is, those with informal provision for pupils' to access the Internet outside of timetabled lessons. The data:

- Identified the informal use of the Internet at school outside of lessons and location of such use, where applicable.
- Identified the type of Internet use outside of lessons:
 - school-related
 - email
 - chat
 - games
 - www browsing
- Identified the frequency of Internet use outside of lessons:
 - Lots: at least once a day
 - Often: less than once a day

- Sometimes: more than once a month
- Rarely: less than once a month
- Never
- Identified favourite www site topics accessed from school.

7.4.3 Section 2

This section collected data on individuals' home access to the Internet:

- Identified the use of the Internet at home and location of access where applicable
- Identified the type of Internet use at home:
 - school-related
 - email
 - chat
 - games
 - www browsing
- Identified the duration of Internet use at home:
 - Lots: at least once a day
 - Often: less than once a day
 - Sometimes: more than once a month
 - Rarely: less than once a month
 - Never
- Identified favourite www site topics accessed from home

7.4.4 Section 3

This section comprised 18 attitudinal statements derived as a result of the previous research studies for this thesis presented in Chapters 4, 5 and 6, and operationalised as below. The attitude items were designed to draw out potential aspects of individuals'

PAtTI relating to: future behaviour intentions in relation to the Internet; views of social interactions on the Internet; confidence in using the Internet; and affective responses to the Internet:

Future Self

I would like to use the Internet in my future work

I don't want to use the Internet in my future work

I don't want to have the Internet in my home when I grow up

I would like to have the Internet in my own home when I grow up

Social Self

Most of my friends don't use the Internet

I have made new friends on the Internet

I haven't made any new friends on the Internet

Confident Self

The Internet is difficult to use

The Internet is easy to use

I feel confident using the Internet

I am not very good at using the Internet

I am good at using the Internet

Reactive Self

I feel nervous using computers at school

I like to use the Internet

I don't want to use the Internet

The Internet is safe to use

The Internet has lots of interesting sites for me

I don't find many interesting sites on the Internet

The stimulus statements deliberately avoided direct gender references, such as ‘girls like to use the Internet’, since the investigative study had found that this style of question produced responses which appeared to be confounded by the ‘We can, I can’t paradox’ (Collis, 1985). The majority of items were therefore referenced directly to the individual respondent, for example ‘I like to use the Internet’, with a minority aimed at universal perceptions, for example ‘The Internet is easy to use’. The statements and response method were pilot tested for comprehension with five children aged 13-15. No difficulties were encountered.

Participants were required to indicate the response which most applied to them for each statement using a Likert scale comprising five categories:

- strongly disagree
- disagree
- not sure
- agree
- strongly agree

7.4.5 Section 4

Participants were invited to write about their career aspirations, to volunteer for further research and to express any further thoughts or opinions about the Internet.

7.5 Administration of the Survey Instrument

Students were surveyed at their schools using a paper-based questionnaire. Appendices C and D relate to the questionnaires used for the ICT-poor and ICT-rich schools respectively. The questionnaire was administered by teachers during lesson time in order to maximise returns and cause least disruption to the schools. This also had the

advantage of avoiding possible contamination of the results due to the presence of the researcher.

The research was carried out with the consent of the Head Teachers of the schools and the teachers directly involved. Approval was also given by the researcher's supervisors; at the time of the research (December 2000 to January 2001) it was not felt that parental consent was a requirement. Ethical guidelines published by BERA (British Educational Research Association: Ethical Guidelines, 1992), for example, advised that parental consent should be obtained if the schools involved suggested it was necessary, which was not the case for this study.

Teachers were asked to advise students to complete the questionnaire independently and assure them of their anonymity of their responses, which would not be individually attributable. Following prevalent practice involving schoolchildren at the time of the research, informed consent and the option to participate or to withdraw from participation at any time were not offered. Explicit consent was not therefore obtained from individual participants, but inferred by their co-operative completion of the questionnaire.

7.6 Survey Analysis

Information from 782 returned questionnaires was entered into a computer spreadsheet and analysis undertaken using SPSS Version 10 and Excel (see Appendix E for the coding schedule). Returned questionnaires were received from all Year 10 children in attendance at Schools Orange, Blue and White, and 50% of School Yellow, at the time of administration of the questionnaire. Incomplete or contradictory returns, for example ticking both a Yes and No option, were completely discarded (n=53), meaning that data from 93% of all potential participants, barring absences from school on the day of

administration, were retained. The examination of the data collected considered aspects of PAttI by drawing upon both overt and inferred information in respect of:

- Take-up of Internet access in voluntary contexts (home/school)
- Type of Internet use
- Frequency of Internet use
- Attitudinal Measures of PAttI

7.7 Results

The following subsections present the results of the survey and details of the analyses. Categorical results are presented first, followed by the attitudinal results; these are then overviewed in a summary section.

7.7.1 Participants

The details of the participants, shown by school and gender are presented in Table 7.1. Data from similar numbers of boys and girls was gathered.

Table 7.1 Participants

	Yellow School (ICT-poor)	Blue School (ICT-rich)	White School (ICT-poor)	Orange School (ICT-rich)	Total
Boys	111	80	89	89	369
Girls	114	81	82	83	360
Total	225	161	171	172	729

7.8 Results of Categorical Analyses

This section presents the results of the categorical measures from the questionnaires, which were intended to ascertain the proposed overt indicators of PAttI: voluntary use of the Internet, type of use, extent of use (and therefore experience), and voluntary access to the Internet in the informal contexts of school and home. Odds ratios were calculated to assess the relative impact of being a boy or girl upon the probable outcome of access to the Internet. Mann-Whitney U tests were applied to investigate the extent of usage between girls and boys. A series of chi-squared tests were carried out in order to explore distributions. The following relationships were examined:

School Context (ICT-rich schools only; that is, those with ICT facilities made available to pupils informally outside lessons):

- Gender and voluntary use of the Internet at school: yes/no
- Gender and location of voluntary use of the Internet at school: classroom, library, another learning area
- Gender and type of voluntary use of the Internet at school for the applications of: school related work, email, chatrooms, games, www browsing
- Gender and frequency of such use:
 - Lots: at least once a day
 - Often: less than once a day
 - Sometimes: more than once a month
 - Rarely: less than once a month
 - Never

Home:

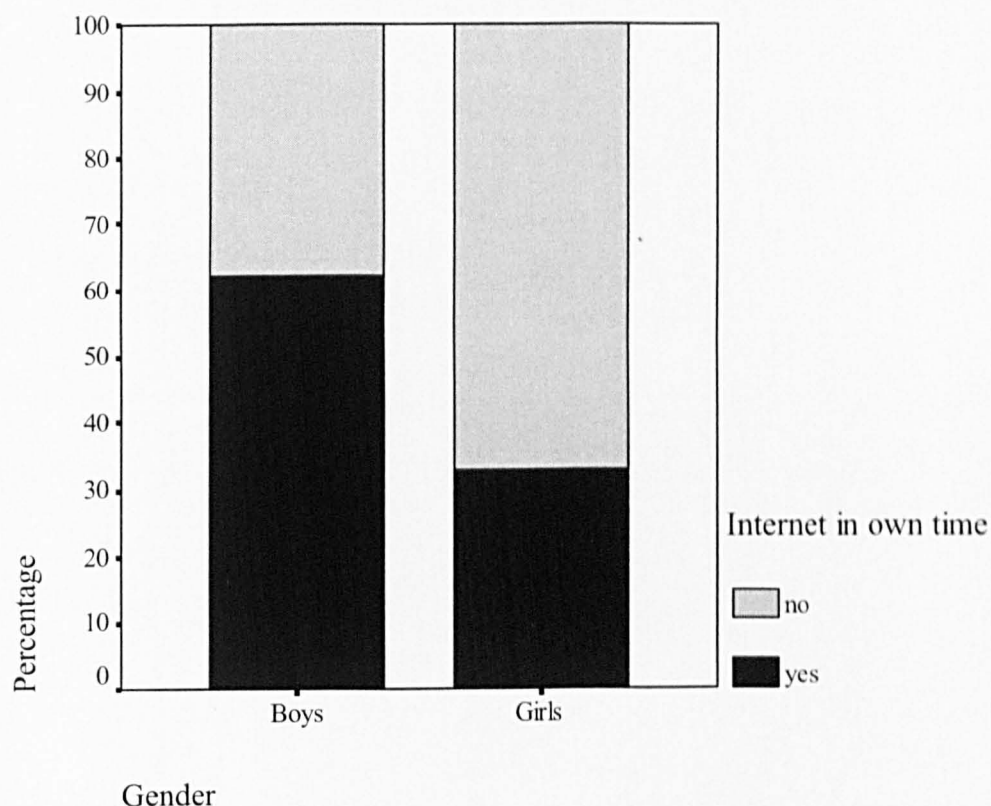
- School type: ICT-rich / ICT-poor; and Internet Access at Home

- School Identity and Internet Access at Home
- Gender and Internet Access at Home
- Gender and Location of Internet Access at Home
- Gender and Type of ICT Use at Home for the applications: school-related work, email, chatrooms, games, www browsing
- Gender and frequency of such use:
 - Lots: at least once a day
 - Often: less than once a day
 - Sometimes: more than once a month
 - Rarely: less than once a month
 - Never

7.8.1 Gender and Voluntary Use of the Internet at School

Within the ICT-rich schools, Blue or Orange, the participants' choice, or not, to use the Internet in their own time at school was examined according to gender. This found a significant difference ($\chi^2=28.45$; d.f.=1; $p<0.001$), with 62% (n=105) of boys compared to only 33% (n=54) of girls electing to make use of informal access to the Internet when at school. An analysis of the odds ratio between the sexes produced an outcome of 3.34 in favour of boys. The distribution of voluntary Internet use between the sexes at schools was almost in inverse proportions, as illustrated in Figure 7.1.

Figure 7.1 Gender and Use of the Internet at School in Own Time



7.8.1.1 Gender and Location of Voluntary Internet Use at School

The sample population was next restricted to participants in ICT-rich schools who indicated that they did use the Internet at school in their own time. This group totalled 159 (boys=105, girls=54). Participants in this group were asked the location in school where they were most likely to use the Internet (classroom, library, other learning area). There was no significant difference between the boys and girls ($\chi^2=0.59$; d.f.=2; $p=0.75$). The most popular location for participants was the library (55%), followed by the classroom (31%).

7.8.1.2 Gender and Type of Voluntary Internet Use at School

The sample population was again restricted to participants in ICT-rich schools who indicated that they did use the Internet at school in their own time. The participants

within this group were then examined by gender for their frequency of voluntary use at school for the following applications:

School-related

Email

Chat

Games

WWW use

Significant gender differences were found within this group for 'games use at school' ($\chi^2 = 18.69$; d.f.=4; $p=0.001$) and 'www use at school' ($\chi^2 = 22.06$; d.f.=4; $p<0.001$) No significant results were found for the other types of application.

Figure 7.2 illustrates the relative distributions for the frequency of use of the Internet at school for games. Compared to the boys, the girls' distribution was skewed towards a lower frequency of use. Fifty-four percent of girls reported never using the Internet at school to play games compared to 23% of boys. A further 22% of girls and 25% of boys selected the category 'rarely'. Overall, 29% of boys selected 'lots' or 'often' compared to only 7% of girls. Twenty-four percent of boys selected the category 'sometimes' compared to 17% of the girls.

Figure 7.2 Use of Internet at School for Games

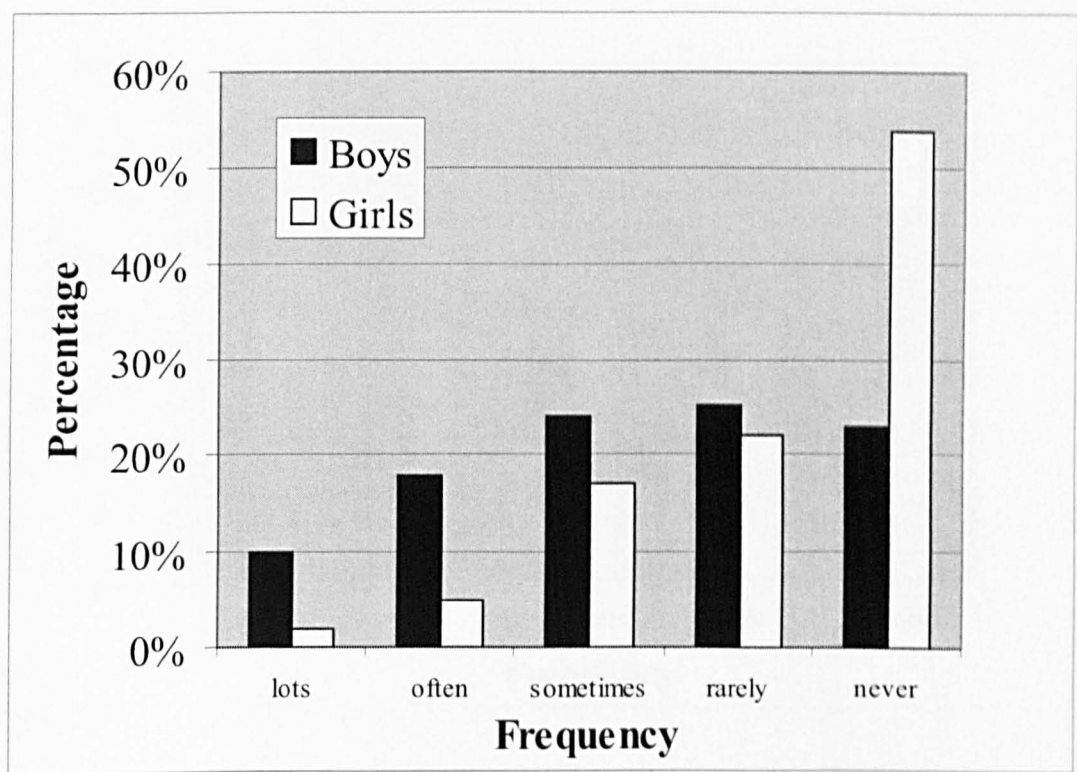
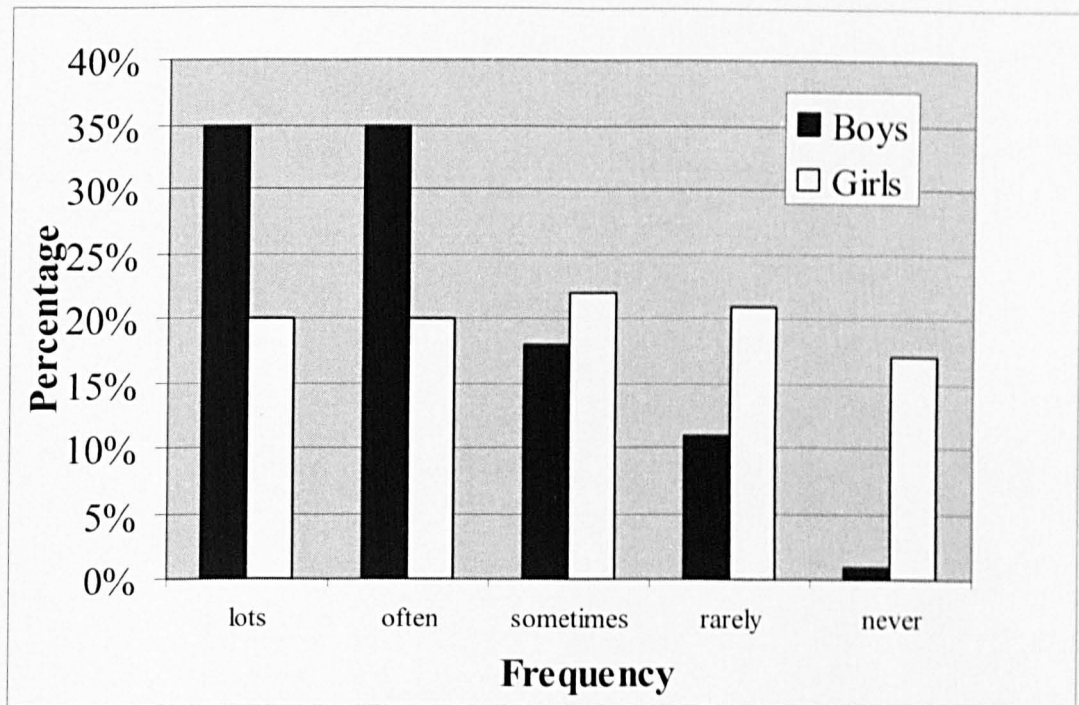


Figure 7.3 illustrates the relative distributions for WWW-browsing amongst voluntary users of the Internet at school. This shows that the boys' responses were skewed towards a higher frequency of use in comparison to the girls, whose responses were more evenly distributed. Boys were more likely than girls to select the category of 'lots' or 'often' (35% compared to 20% in both cases) for WWW-browsing in their own time at school. More girls (21%) than boys (11%) selected the category of 'rarely' and 17% of girls never used the Internet at school in their own time for WWW-browsing, in contrast to only 1% of boys.

Figure 7.3 Use of Internet at School for WWW-browsing



7.8.1.3 Gender and Frequency of Voluntary Internet Use level at School

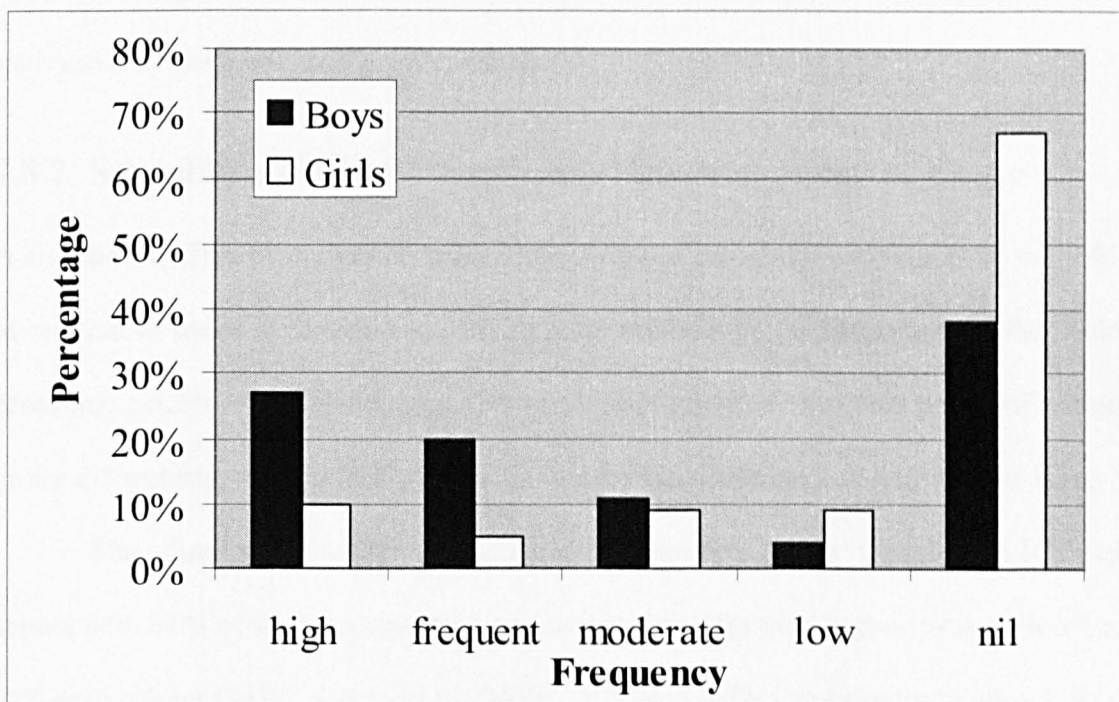
The 'user' level, indicating the frequency of voluntary use amongst participants at ICT-rich schools, was examined by gender. This was calculated by taking the highest frequency of occurrence from across all of the applications. In this way, a fair comparison of frequency of use between the sexes was possible, avoiding potentially gendered choices of application use from confounding the data. The result was significant, $\chi^2=43.75$; d.f.=4; $p<0.001$.

Sixty-seven per cent of girls elected never to use the Internet at school in informal, voluntary situations, in contrast to 38% of boys. Boys were more likely to be high or frequent users (47% overall in these categories) compared to girls (15%). Examination of the distribution shown in Figure 7.4 shows that of participants who did

use the Internet at school, boys were more positively skewed towards the higher levels of use with a frequency range of 4-27% compared to the girls, whose range was 5-10%.

In order to examine potential differences between boys and girls in the degree of usage overall, the Mann-Whitney U test was applied. This found a significant difference between boys and girls, Mann-Whitney $z = -2.61$, $p=0.009$.

Figure 7.4 Gender and User Level at School



7.8.1.4 Summary of Voluntary Internet Access at School

Overall, it can be concluded that the boys in this study were more likely to make use of informal Internet access at school than the girls (62% compared to 33%). Preferred location of access at school, the library, did not vary between boys and girls.

When girls did voluntarily use such Internet access at school, there were significant differences between them and the boys for the Internet applications of games use and www browsing, but not for school-related use, chat, or email. The boys were more likely to use the Internet at school for games (77%) compared to the girls (46%)

and to be more frequent users; and 17% of girls reported never using the Internet at school for personal WWW-browsing in contrast to 1% of boys. Of those children who did browse, frequency of use was far more positively skewed for the boys.

Looking at the distribution of levels overall for frequency of use, boys' usage was more positively skewed towards a greater frequency of use, whereas the girls' distribution was relatively even. Not only were the boys in this study more likely to make voluntary use of the Internet at school than the girls, but even when girls did make such use they were not such prolific users.

7.8.2 School Identity and Participants' Internet Access at Home

A significant effect of individual school attended was found ($\chi^2=19.61$; d.f.=3; $p<0.001$) in relation to home access levels. This may be attributable to differences in the socio-economic catchment areas for each school. A later analysis examines potential within-group differences, namely ICT-poor or ICT-rich school attended, to address this issue.

The school with the highest incidence of home access was 'Orange', an ICT-rich school with 81% of students reporting access at home. The next highest was 'White', an ICT-poor school (74%), followed by 'Blue', ICT-rich (68%) and finally 'Yellow', ICT-poor (61%). Students from all of the schools, did however, have Internet access at home well above average UK household penetration, which even by February 2002 stood at 46% (OfTel, 2002).

7.8.3 Gender and Internet Access at Home

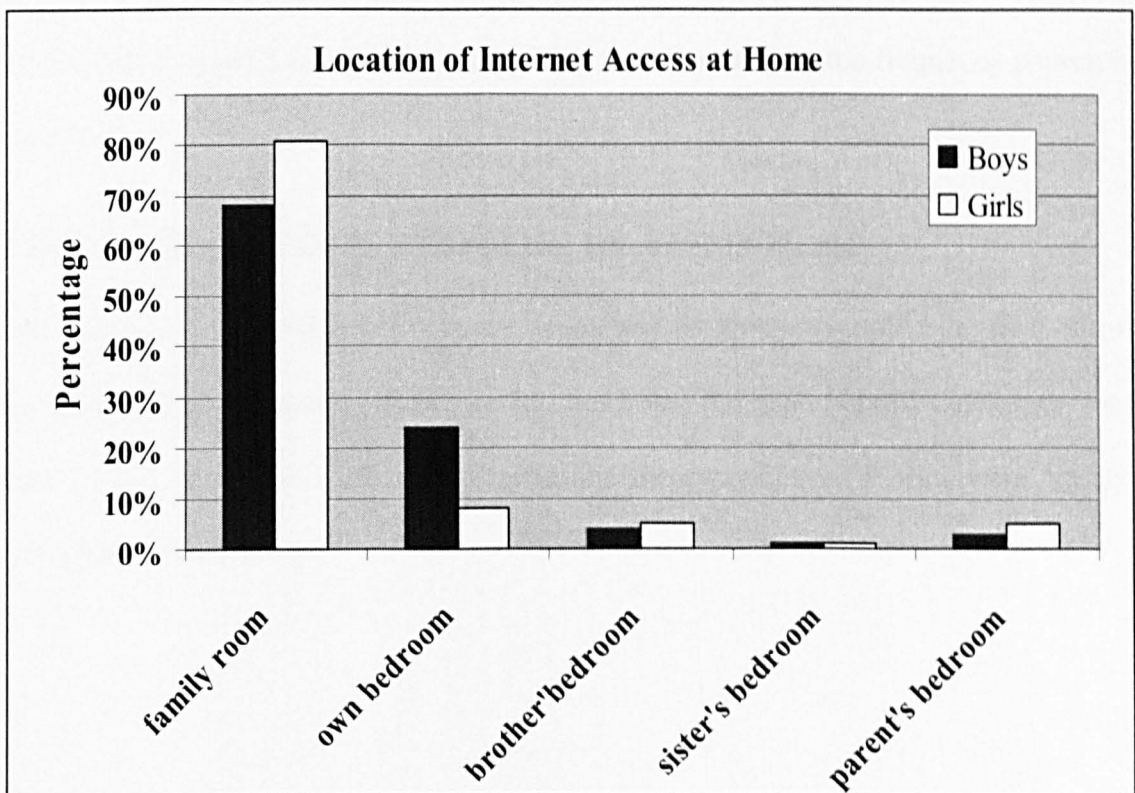
All the participants in this study were examined for home Internet access. Girls were less likely to access the Internet at home than boys; 66% of girls ($n=239$) compared to 74% of boys ($n=274$). This result was significant ($\chi^2=5.41$; d.f.=1; $p=0.02$). An analysis of the odds ratios between the sexes found a result of 1.46 in favour of boys.

7.8.4 Gender and Location of Internet Access at Home

The sample population was again restricted to participants who indicated that they used the Internet at home.

The result for the distribution between the sexes for location of Internet access in the home was significant, $\chi^2=22.92$; d.f.=4; $p<0.001$. The most popular location for accessing the Internet at home was in a family room for both boys and girls; however, more girls (81%) than boys (68%) came into this category. Boys were also three times more likely to have Internet access in their own bedroom than girls (24% compared to 8%). Figure 7.5 illustrates this.

Figure 7.5 Location of Internet Access at Home



7.8.5 Gender and Types of ICT Use at Home

The sample population was again restricted to participants who indicated that they used the Internet at home. The participants within this group were then examined by gender for their frequency of use of the Internet for the applications of:

School-related use

Email use

Chat Use

Games Use

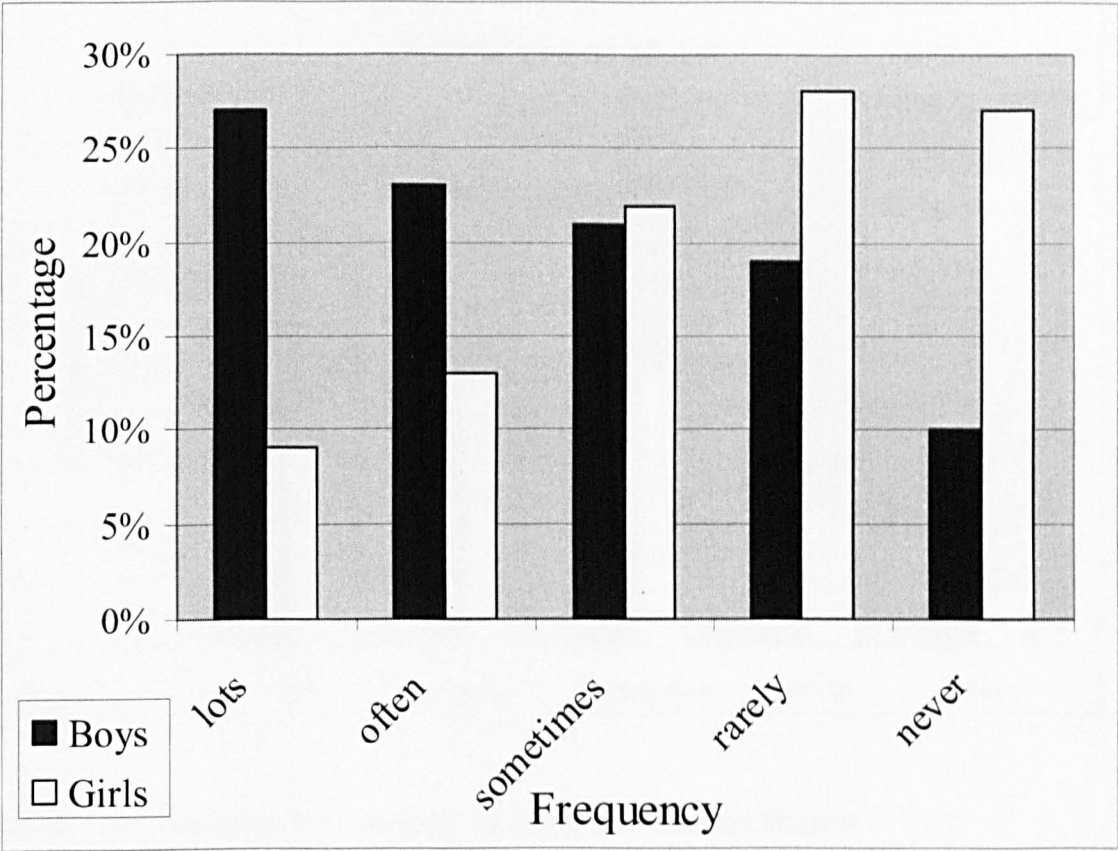
WWW Use

Significant gender differences were found within this group for 'games use at home' ($\chi^2=52.86$; d.f.=4; $p<0.001$) and 'WWW use at home' ($\chi^2=86.80$; d.f.=4; $p<0.001$), but not for school-related use, email, or chat. This outcome mirrors the frequency pattern of use at school.

7.8.6 Gender and Games Use of the Internet at Home

The pattern of distribution between the sexes was an almost complete reversal across the categories, as illustrated in Figure 7.6. For boys, the most popular categories were 'lots' (27%) and 'often' (23%). For girls, the most popular categories were 'rarely' (29%) and 'never' (27%).

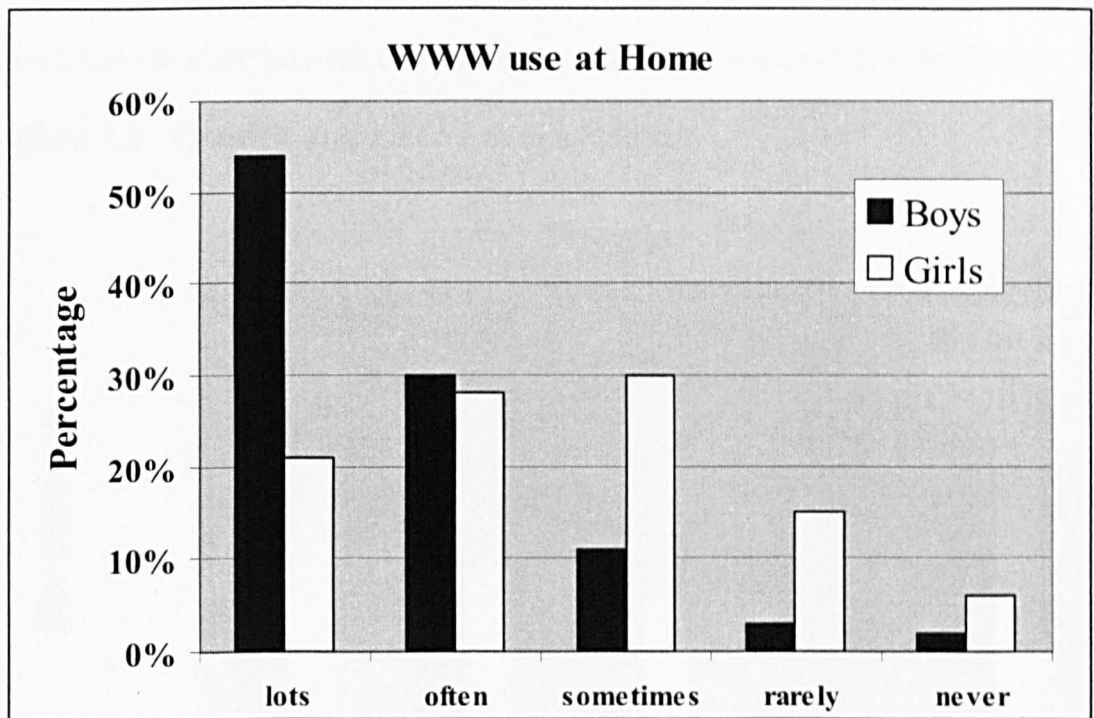
Figure 7.6 Use of the Internet at Home for Games



7.8.7 Gender and WWW Use at Home

For boys, the most popular category was ‘lots’ with 54% selecting this response, compared to 21% of girls. For girls the most popular category was ‘sometimes’, which was selected by 30%. For both sexes, only a small minority (2% of boys and 6% of girls) said they never accessed the Internet at home for www-browsing. Figure 7.7 illustrates the relative patterns of distribution, showing that the girls’ frequency of use is again more symmetrical compared to the boys’, which is skewed towards more frequent use.

Figure 7.7 WWW Use at Home



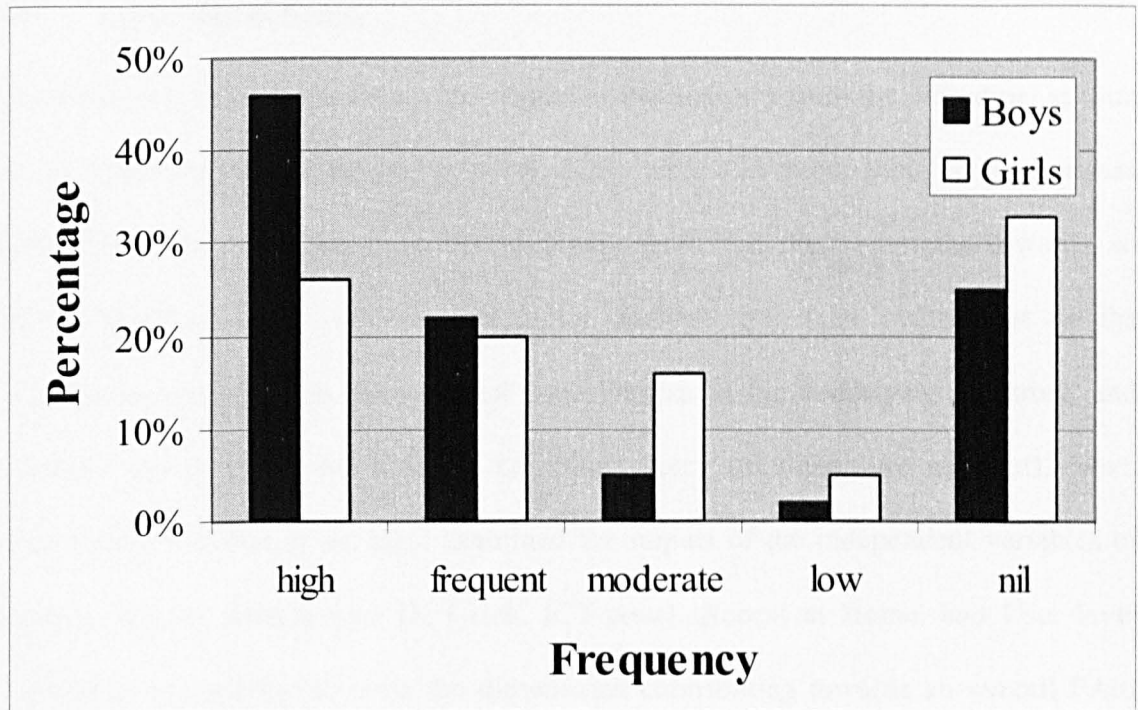
7.8.8 Gender and Frequency of Internet Use at Home

The 'user' level, indicating the frequency of voluntary home use of the Internet, and therefore experience, was examined by gender for all participants. User level was calculated by taking the highest frequency of occurrence from across all of the applications. In this way, a fair comparison of frequency of use between the sexes was possible, avoiding potentially gendered choices of application use from confounding the data. The result was significant, $\chi^2=47.56$; d.f.=4; $p<0.001$.

Examination of the distribution found that of all participants, 46% of boys reported high frequency of Internet use at home, compared to 26% of girls. Girls were more likely to be represented in the nil, low, and moderate categories. Figure 7.8 illustrates this distribution, showing that of those children who did report use of the Internet at home, the boys' results were more steeply skewed towards the positive end of the scale.

In order to examine potential differences between boys and girls in the overall degree of Internet usage at home, the Mann-Whitney U test was applied. This found a significant difference between boys and girls, Mann-Whitney $z = -5.255$, $p < 0.001$.

Figure 7.8 Gender and User Level at Home



7.8.9 Summary of Internet Access and Use at Home

Boys' Internet access at home was significantly greater than the girls', although for both groups Internet access exceeded national averages at the time of the survey. Boys and girls were significantly different in their frequency of use for both games and WWW-browsing use of the Internet at home, with boys' use exceeding girls', but not for email, chat or school-related use. This outcome repeated the pattern found for school use of applications in the ICT-rich schools.

Overall, the boys in this study were more frequent users of the Internet at home. Examination of the relative proportions of boys and girls voluntarily using the Internet at school, for ICT-rich schools only, compared to those accessing the Internet at home,

found that in the former situation only 33% of the girls chose to access the Internet compared to 66% in the latter. Boys were not impacted, in terms of voluntary access, by the context to the same extreme; 62% of boys voluntarily used the Internet at school, compared to 74% at home.

7.9 Attitudinal Scale

The following subsections set out the results of the analyses from the attitudinal section of the questionnaire. Firstly, issues of reliability were addressed. Next, factor analyses were carried to determine contributing components and their strengths towards an overall PAttI score. A second-order factor analysis was then carried out on the components to determine the potential cohesiveness of the underlying construct, and therefore the potential for a single combined score as a measure of PAttI. Next, multivariate analyses of variance examined the impact of the independent variables of Gender, School, School type (ICT-rich, ICT-poor), Access at Home, and User level (indicative of experience) upon the dimensions contributing towards an overall PAttI measure.

7.9.1 Reliability

In order to maintain a unified direction during analysis the values were reversed for negative items. The internal consistency of the attitude scale was measured by carrying out a reliability analysis using SPSS, calculating Cronbach's alpha coefficient for the scale overall. This produced a result of 0.86, which would normally be regarded as a satisfactory level of reliability, with 0.70 typically being the cut-off point for acceptability (Nunnally, 1978; Robinson et al., 1991). The figures calculating the impact upon the alpha in the event of an item being deleted from the scale gave a range

of 0.85 to 0.87, therefore deleting any of the items would make no substantial difference and all items were retained.

7.9.2 Principal Components analysis

The 18 items from the attitudinal scale were subjected to principal components analysis (PCA) using SPSS. Prior to performing PCA, the suitability of data for factor analysis was assessed.

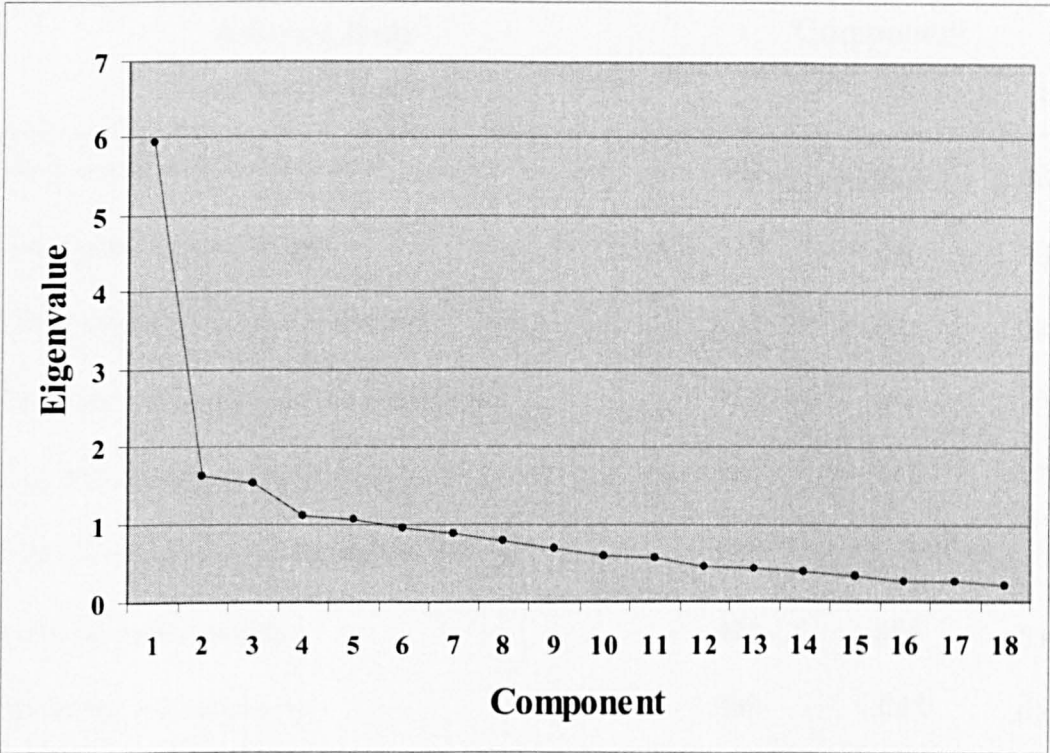
The determinant value of the correlation matrix was 0.0008574 which is greater than the necessary value of 0.00001; therefore multicollinearity was not an issue for this data. The Kaiser-Meyer-Olkin value was 0.854, exceeding the recommended value of 0.6 (Field, p.455, 2000) and the Barlett's Test of Sphericity (Field, p. 457, 2000) reached statistical significance, supporting the factorability of the correlation matrix.

Principal components analysis revealed the presence of five components with eigenvalues exceeding 1 accounting for 62.53 % of the overall variance. Table 7.2 presents the initial eigenvalues and component values. The latter two components only just exceeded an eigenvalue of 1. Examination of the scree plot using Cattell's Scree test (Kline, p.75,1994) suggested that it would be more appropriate to extract three factors (Cliff, 1988). Figure 6.9 illustrates this. This was further confirmed by the results of a parallel analysis of 1,000 random correlation matrices using the program written by O'Connor (2000) which found that the first three eigenvalues lay beyond the 95th percentile and were therefore statistically significant.

Table 7.2 Total Variance Explained

Initial Eigenvalues			
Component	Total	% of Variance	Cumulative %
1	5.943	33.02	33.02
2	1.615	8.97	41.99
3	1.526	8.48	50.47
4	1.111	6.17	56.64
5	1.060	5.89	62.53
6	.944	5.25	67.77
7	.873	4.85	72.62
8	.779	4.33	76.95
9	.680	3.78	80.73
10	.593	3.30	84.03
11	.554	3.08	87.10
12	.459	2.55	89.65
13	.427	2.37	92.03
14	.377	2.10	94.12
15	.325	1.81	95.93
16	.265	1.47	97.40
17	.254	1.41	98.81
18	.214	1.19	100.00

Figure 7.9 Scree Plot



PCA was therefore used to extract three factors. The extracted matrix was submitted to oblique rotation by SPSS oblimin method, revealing a simple structure with all items showing significant loadings and only one item exceeding 0.3 loading on more than one factor, as presented in Table 7.3.

Table 7.3 Pattern Matrix

Attitude Item (*Items reversed scored)	Component			
	1	2	3	
the Internet is difficult to use*	.842	-.066	.027	
the Internet is easy to use	.820	.030	-.011	
I feel confident using the Internet	.752	.041	.086	
I am not very good at using the Internet*	.710	.050	.160	
I am good at using the Internet	.707	.111	.179	
I feel nervous using computers at school*	.528	.041	-.175	
I like to use the Internet	.416	.384	.036	
the Internet is safe to use	.309	-.035	.024	
I would like to use the Internet in my future work	-.134	.773	.101	
I don't want to use the Internet in my future work*	-.165	.745	.149	
I don't want to have the Internet in my home when I grow up*	-.003	.650	-.060	
I would like to have the Internet in my own home when I grow up	.145	.633	.005	
I don't want to use the Internet*	.195	.524	-.008	
The Internet has lots of interesting sites for me	.160	.505	.025	
I don't find many interesting sites on the Internet*	.294	.418	-.055	
Most of my friends don't use the Internet*	-.014	.403	-.061	
I have made new friends on the Internet	.049	.055	.902	
I haven't made any new friends on the Internet*	.091	-.016	.896	
Factor Correlations:	Component 1	1.000	.438	.182
	Component 2	.438	1.000	.186
	Component 3	.182	.186	1.000

Components with loadings exceeding 0.3 are emboldened

Examination of the items loading onto particular factors suggested three potential subscale descriptors. The first component consisted mainly of attitudinal statements relating to confidence:

- The Internet is difficult to use
- The Internet is easy to use
- I feel confident using the Internet
- I am not very good at using the Internet
- I am good at using the Internet
- I feel nervous using computers at school
- I like to use the Internet
- The Internet is safe to use

The second component indicated items which related to personal future behaviour intentions and perceived personal relevance of the Internet:

- I would like to use the Internet in my future work
- I don't want to use the Internet in my future work
- I don't want to have the Internet in my home when I grow up
- I would like to have the Internet in my own home when I grow up
- I don't want to use the Internet
- the Internet has lots of interesting sites for me
- I don't find many interesting sites on the Internet
- most of my friends don't use the Internet

The third component comprised the two items relating to the Internet as a source of new friendships:

- I have made new friends on the Internet
- I haven't made any new friends on the Internet

The three components therefore were given the defining labels of 'Internet Confidence', 'Personal Relevance of the Internet' and 'Internet Friendship', with each scale having a logical score range of 1-5.

The three subscales indicated by these results were separately subjected to a reliability analysis calculating Cronbach's (1951) alpha coefficient in order to establish their individual degree of internal consistency. The subscale labelled 'Internet Confidence' produced an alpha of 0.84; 'Personal Relevance of the Internet' an alpha of 0.77; and 'Internet friendship' an alpha of 0.86. The results indicated a high degree of internal reliability within these three suggested subscales.

7.9.3 Second Order Analysis

The mean scores were calculated for all participants within the three subscales and tested for correlation. All three subscales showed a statistically significant correlation, $p < 0.01$. Table 7.4 presents details of the correlations between the components, showing that all three were positive, with Internet Confidence and Personal Relevance of the Internet providing the strongest correlation.

Table 7.4 Correlations

	Internet Confidence	Personal Relevance of the Internet
Internet Friendship	.317	.274
Internet Confidence		.561

In order to identify global dimensions of the concept of Psychological access, a second order factor analysis was carried out using the overall mean scores for each of the components of ‘Internet Confidence’, ‘Personal Relevance of the Internet’ and ‘Internet friendship’.

The determinant value of the correlation matrix was 0.607 which was greater than the necessary value of 0.00001, therefore multicollinearity was not an issue for this data. The Kaiser-Meyer-Okin value was 0.600 equalling the recommended value of 0.6 or above (Field, p. 455, 2000) meaning that distinct and reliable factors should be generated. Bartlett’s 1954 test of sphericity reached statistical significance, supporting the factorability of the correlation matrix (Field, p.457, 2000).

Principal components analysis revealed the presence of one global component with an eigenvalue exceeding 1, accounting for 60% of the overall variance. Table 7.5 shows the loadings of the 3 subscales on the global component, revealing that the Confidence and Relevance subscales contributed the greatest, and were of similar, amounts.

Table 7.5 Loadings from Second Order Factor Analysis

Subscale	Loadings
Internet Confidence	0.843
Personal Relevance of the Internet	0.823
Internet Friendship	0.629

The global item found from this analysis is proposed as the final indicator of a psychological construct, the attitude ‘Psychological Access to the Internet’ (PAttI). This is measured by the total mean score of the subscales, ‘Internet Confidence’, ‘Personal Relevance of the Internet’ and ‘Internet friendship’, which, it is argued, are reflecting contributory dimensions of the overall construct.

7.10 PAttI Score Analyses In Context

This section examines the effect of gender, context of Internet use and degree of experience as measured by frequency of use, upon participants’ PAttI scores. The contexts considered were firstly attendance at an ICT-poor school, followed by informal voluntary use of the Internet at an ICT-rich school, and finally use of the Internet at home for all participants. User level (experience) was categorised according to the frequency of use in each context as appropriate and was calculated by taking the highest frequency of occurrence across all of the applications of use. In this way, a fair comparison of frequency of use between the sexes was possible, avoiding potentially gendered choices of application use from confounding the data.

7.10.1 Children Attending an ICT-poor School

A multivariate analysis of variance was carried out on the three PAttI dimensions of ‘Internet Confidence’, ‘Internet Friendship’ and ‘Personal Relevance of the Internet’ for the children from the ICT-poor schools only, using gender, school attended, and user

level at home as independent variables. User level was defined by the frequency of home use of the Internet: 'high, frequent, moderate, low, nil'.

A significant multivariate main effect of user level at home was found ($F=15.21$; $d.f.=12, 989$; $p=0.001$; $\eta_p^2=0.14$). The user level univariates for all three PAttI dimensions were significant; Internet Friendship ($F=25.29$; $d.f.=4, 376$; $p=0.001$; $\eta_p^2=0.21$), Internet Confidence ($F=34.33$; $d.f.=4, 376$; $p=0.001$; $\eta_p^2=0.27$), and Personal Relevance of the Internet ($F=12.51$; $d.f.=4, 376$; $p=0.001$; $\eta_p^2=0.12$). Gender was also significant for Personal Relevance of the Internet ($F=4.66$; $d.f.=1, 395$; $p=0.032$; $\eta_p^2=0.012$) with boys' mean scores (4.0) exceeding the girls' (3.8); Internet Confidence narrowly missed significance at $p=0.059$. There were no significant differences between the two ICT-poor schools, or significant interactions between the independent variables. Tables 7.6, 7.7 and 7.8 present the mean scores for the independent variables across the three PAttI dimensions.

Table 7.6 Gender Mean Scores for ICT-poor Schools

Dependent Variable	Gender	Mean	Std. Error
Friendship	Boys	2.48	.17
	Girls	2.56	.10
Confidence	Boys	3.61	.08
	Girls	3.43	.05
Relevance	Boys	3.99	.08
	Girls	3.80	.04

Table 7.7 School Identity Mean Scores for ICT-poor Schools

Dependent Variable	School	Mean	Std. Error
Friendship	Yellow	2.53	.15
	White	2.51	.13
Confidence	Yellow	3.47	.07
	White	3.57	.06
Relevance	Yellow	3.88	.07
	White	3.91	.06

Table 7.8 User Level at Home Mean Scores for ICT-poor Schools

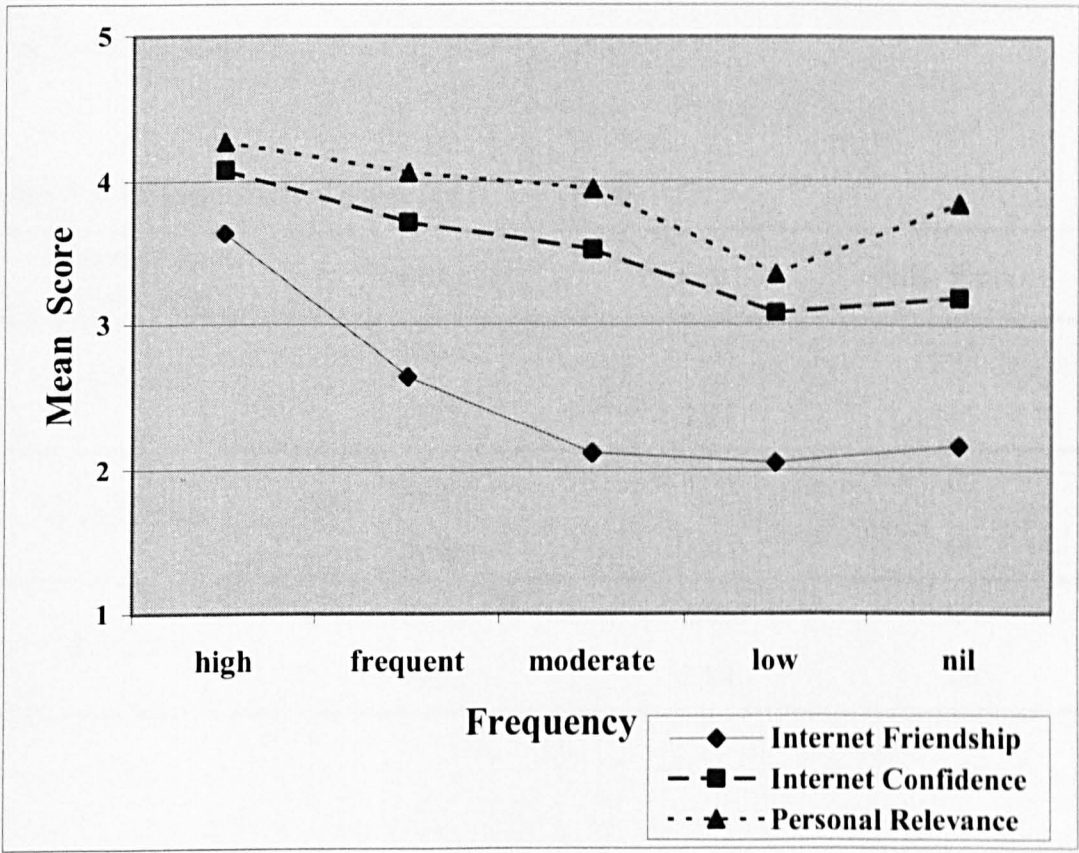
Dependent Variable	User Level	Mean	Std. Error
Friendship	high	3.64	.11
	frequent	2.64	.13
	moderate	2.12	.21
	low	2.05	.40
	nil	2.16	.11
Confidence	high	4.08	.06
	frequent	3.73	.07
	moderate	3.53	.10
	low	3.09	.19
	nil	3.19	.06
Relevance	high	4.27	.05
	frequent	4.06	.06
	moderate	3.95	.09
	low	3.36	.18
	nil	3.84	.05

Where children were electing to use the Internet at home, examination of the means (Table 7.8) revealed that this related to an increase in all three PAttI dimensions scores with progressive frequency of use. Figure 7.10 illustrates this trend.

As can be observed, children who reported a ‘nil’ use of the Internet had higher levels for the three PAttI dimensions than those reporting low levels of use at home. The underlying reasons for this are not obvious. It could be argued that children

experiencing low levels of use have actually adjusted their perceptions to a more realistic level with greater awareness of their personal level of relative skill, compared to those reporting 'nil' use, and that this has impacted upon their PAttI scores.

Figure 7.10 Mean PAttI Scores for User Level at Home: Children Attending ICT-poor Schools



7.10.2 Children Attending an ICT-rich School

A multivariate analysis of variance was carried out on the 3 PAttI dimensions of 'Internet Confidence', 'Internet Friendship' and 'Personal Relevance of the Internet' for the children from the ICT-rich schools only, using gender, school attended, user level at home and user level at school outside of timetabled lessons: 'high, frequent, moderate, low, nil' as independent variables.

A significant multivariate main effect of user level at home was found, $F=2.54$; $d.f.=12, 704$; $p=0.003$; $\eta_p^2=0.04$. The univariates for user level at home were all significant; Internet Friendship: $F=5.15$; $d.f.=4, 268$; $p=0.001$; $\eta_p^2=0.07$; Internet Confidence: $F=2.57$; $d.f.=4, 268$; $p=0.038$; $\eta_p^2=0.04$; and Personal Relevance of the Internet: $F=2.86$; $d.f.=4, 268$; $p=0.024$; $\eta_p^2=0.04$. Gender, school attended, and user level at school were nonsignificant. There were no significant interactions. Tables 7.9, 7.10, 7.11 and 7.12 present the mean scores for the independent variables across the three PAttI dimensions.

Table 7.9 Gender Mean Scores for ICT-rich Schools

Dependent Variable	Gender	Mean	Std. Error
Friendship	Boys	2.23	.13
	Girls	2.71	.15
Confidence	Boys	3.94	.07
	Girls	3.63	.08
Relevance	Boys	4.06	.06
	Girls	3.94	.06

Table 7.10 School Identity Mean Scores for ICT-rich Schools

Dependent Variable	school identity	Mean	Std. Error
Friendship	Blue	2.55	.14
	Orange	2.41	.14
Confidence	Blue	3.75	.07
	Orange	3.80	.07
Relevance	Blue	4.02	.06
	Orange	3.96	.06

Table 7.11 User Level at Home Mean Scores for ICT-rich Schools

Dependent Variable	user status	Mean	Std. Error
Friendship	high	3.08	.17
	frequent	2.53	.21
	moderate	2.69	.28
	low	1.55	.51
	nil	1.86	.18
Confidence	high	4.00	.09
	frequent	3.91	.11
	moderate	3.62	.14
	low	3.29	.26
	nil	3.62	.09
Relevance	high	4.13	.07
	frequent	4.14	.09
	moderate	3.83	.12
	low	3.53	.22
	nil	3.94	.08

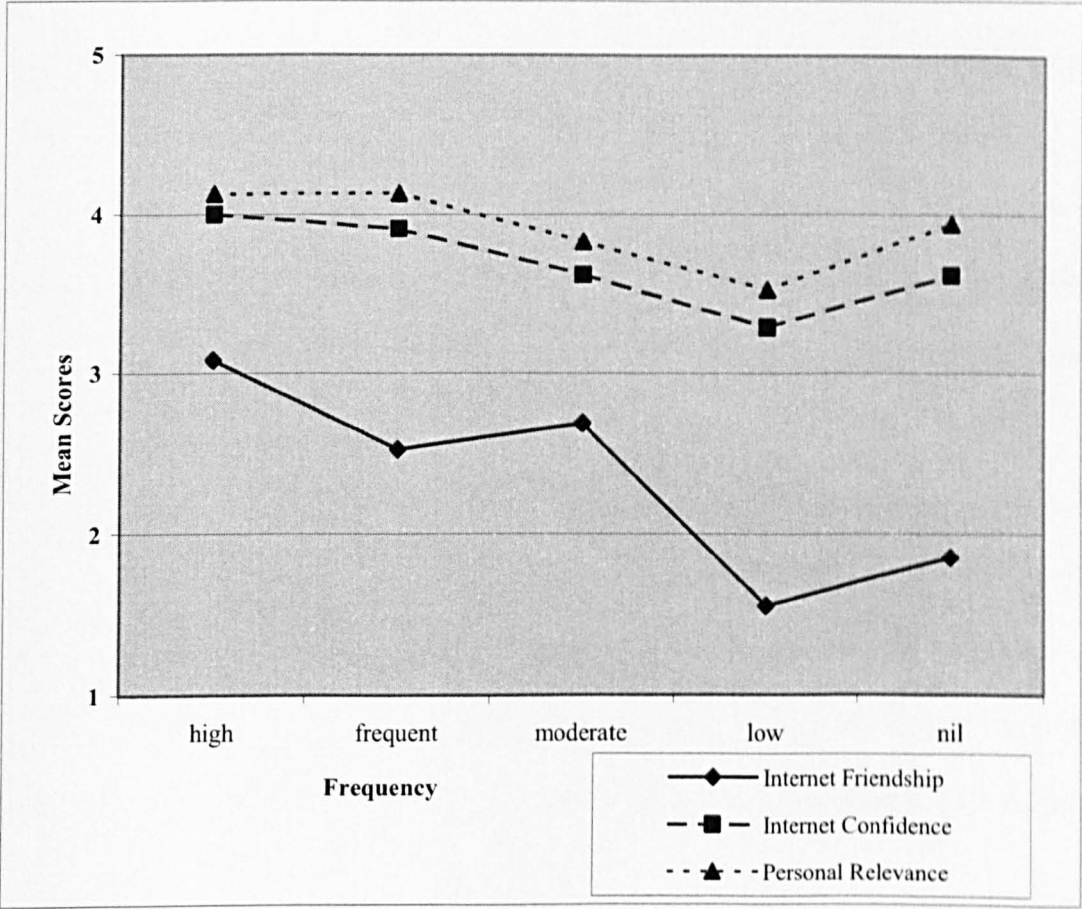
Table 7.12 User Level at School Mean Scores for ICT-rich Schools

Dependent Variable	User Level at School	Mean	Std. Error
Friendship	high	2.46	.21
	frequent	2.23	.23
	moderate	2.43	.25
	low	2.99	.31
	nil	2.39	.15
Confidence	high	4.09	.11
	frequent	3.83	.12
	moderate	3.83	.13
	low	3.53	.15
	nil	3.68	.07
Relevance	high	4.11	.09
	frequent	4.05	.10
	moderate	4.15	.11
	low	3.84	.13
	nil	3.88	.06

Examination of the means presented in Table 7.11, revealed that where children were electing to use the Internet at home, this related to an increase for the PAttI dimensions of Internet Confidence and Personal Relevance of the Internet, which increased with

progressive frequency of Internet use. The Internet Friendship mean scores for user frequency level showed a dip in the ‘frequent’ category, although the overall scores were again higher for the categories reflecting greater use amongst those children choosing to use the Internet at home. Figure 7.11 illustrates this. As in the case of children attending an ICT-poor school, children reporting a ‘nil’ use of the Internet at home had higher levels for the three PAttI dimensions than those reporting ‘low’ levels of use.

Figure 7.11 User Level at Home of Children Attending ICT-Rich Schools



7.10.3 All Participants

The analyses reported in the two preceding subsections demonstrated that there were no significant differences attributable to attendance at either of the two schools in the ICT-poor category, or attendance at either of the two schools in the ICT-rich category, for the dependent measures of children's attitudes. In other words, attendance at either of the schools within the ICT-poor group was not a factor for independent consideration, and similarly within the ICT-rich group. Further, for those children attending an ICT-rich school, the user level at school was not significant when user level at home is taken into account. The following analysis examines the effect of gender, attendance at an ICT-rich or ICT-poor school and the level of Internet experience in the home, user level, upon the children's PAttI scores. As previously, user level was categorised was calculated by taking the highest frequency of use across all of the applications.

A multivariate analysis of variance was carried out on the three PAttI dimensions of 'Internet Confidence', 'Internet Friendship' and 'Personal Relevance of the Internet' for all children, using gender, ICT-rich/ICT-poor school attended, and user level at home as independent variables.

Gender, ICT-rich/ICT-poor school attended and user level at home were found to all be significant multivariate main effects; gender: $F=7.56$; d.f.=3, 707; $p<0.001$; $\eta_p^2=0.03$; ICT-rich/ICT-poor school attended: $F=3.67$; d.f.=3, 707; $p=0.012$; $\eta_p^2=0.02$; and user level: $F=22.76$; d.f.=12, 1870; $p<0.001$; $\eta_p^2=0.11$. Tables 7.13, 7.14, and 7.15 present the mean scores for the independent variables across the three PAttI dimensions.

Table 7.13 Gender Mean Scores for All Participants

Dependent Variable	Gender	Mean	Std. Error
Friendship	Boys	2.30	.12
	Girls	2.58	.09
Confidence	Boys	3.75	.06
	Girls	3.47	.05
Relevance	Boys	4.00	.05
	Girls	3.80	.04

Table 7.14 ICT-rich/ICT-poor Mean Scores for All Participants

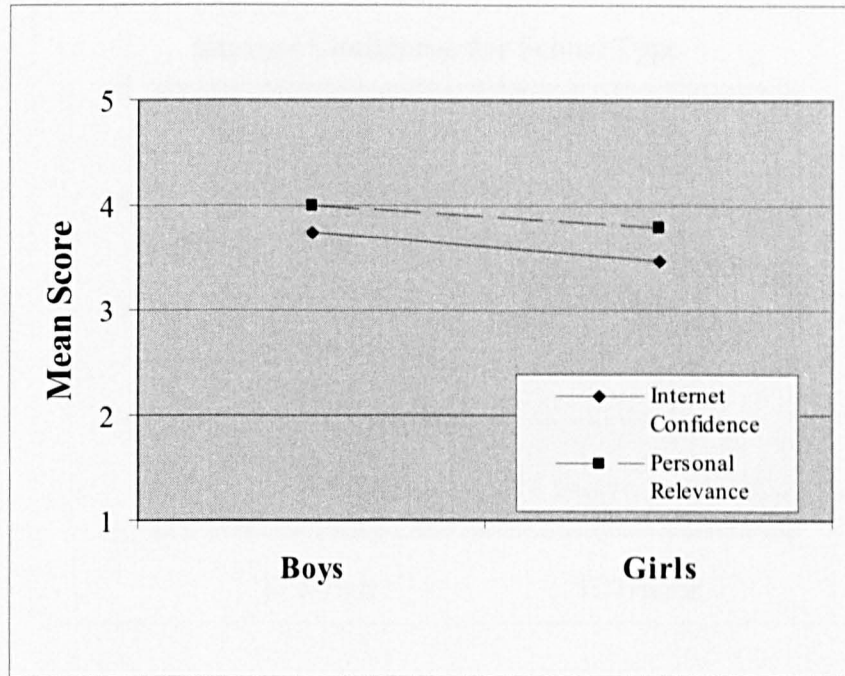
Dependent Variable	Type of School	Mean	Std. Error
Friendship	ICT-Rich	2.35	.12
	ICT-poor	2.53	.10
Confidence	ICT-Rich	3.71	.06
	ICT-poor	3.51	.05
Relevance	ICT-Rich	3.91	.05
	ICT-poor	3.89	.04

Table 7.15 User Level at Home Mean Scores for All Participants

Dependent Variable	User Level at Home	Mean	Std. Error
Friendship	high	3.45	.08
	frequent	2.60	.10
	moderate	2.28	.16
	low	1.8	.31
	nil	2.04	.08
Confidence	high	4.06	.04
	frequent	3.83	.05
	moderate	3.57	.08
	low	3.22	.16
	nil	3.36	.04
Relevance	high	4.23	.03
	frequent	4.06	.04
	moderate	3.92	.07
	low	3.44	.14
	nil	3.83	.04

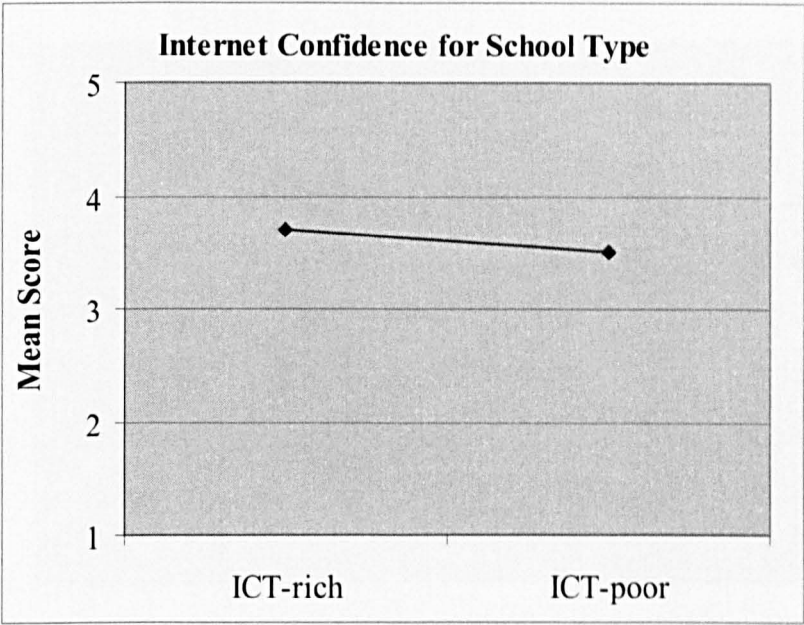
The univariates for gender were significant for Internet Confidence, $F=12.80$; d.f.=1, 709 ; $p<0.001$; $\eta_p^2=0.02$, and for Personal Relevance of the Internet, $F=9.51$;d.f.=1, 709; $p=0.002$; $\eta_p^2=0.01$. Examination of the means, shown in Table 7.13, show that boys' scores exceeded girls on these two dimensions. Figure 7.12 illustrates this. Girls' means exceeded boys for Friendship, however this was nonsignificant, $F=3.33$;d.f.=1, 709; $p=0.068$.

Figure 7.12 Significant Univariates for Gender



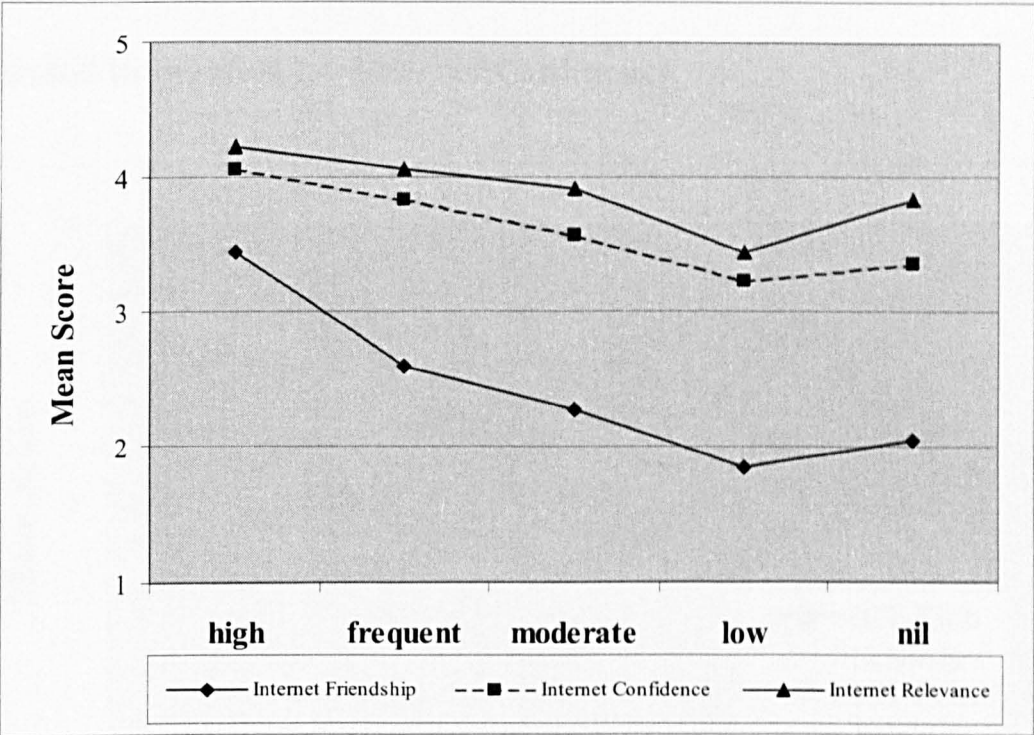
The univariates for school type, ICT-rich or ICT-poor, were significant for Internet Confidence, $F=7.30$; $d.f.=1, 709$; $p=0.007$; $\eta_p^2=0.01$ only. Examination of the means, shown in Table 7.13, revealed that children attending an ICT-rich school scored higher than those attending an ICT-poor school for this PAttI dimension. Figure 7.13 illustrates this. Internet Friendship and Personal Relevance of the Internet were nonsignificant, respectively: $F=1.48$; $d.f.=1, 709$; $p=0.224$; and $F=0.132$; $d.f.=1, 709$; $p=0.717$.

Figure 7.13 Internet Confidence for School Type



The univariates for user level at home were significant for all three dimensions of PAttI: Internet Friendship, $F=43.02$; d.f.=4, 709; $p=0.001$; $\eta_p^2=0.20$, Internet Confidence, $F=42.15$; d.f.=4, 709 ; $p=0.001$; $\eta_p^2=0.19$, and Personal Relevance of the Internet, $F=21.40$; d.f.=4, 709; $p=0.001$; $\eta_p^2=0.11$. Examination of the means shown in Table 7.15, revealed that where users were choosing to access the Internet at home, their mean scores increased with the frequency of use. Figure 7.14 illustrates this, and also illustrates the anomaly in the ‘nil’ category compared to the ‘low’ category as previously noted.

Figure 7.14 Significant Univariates for User Level at Home

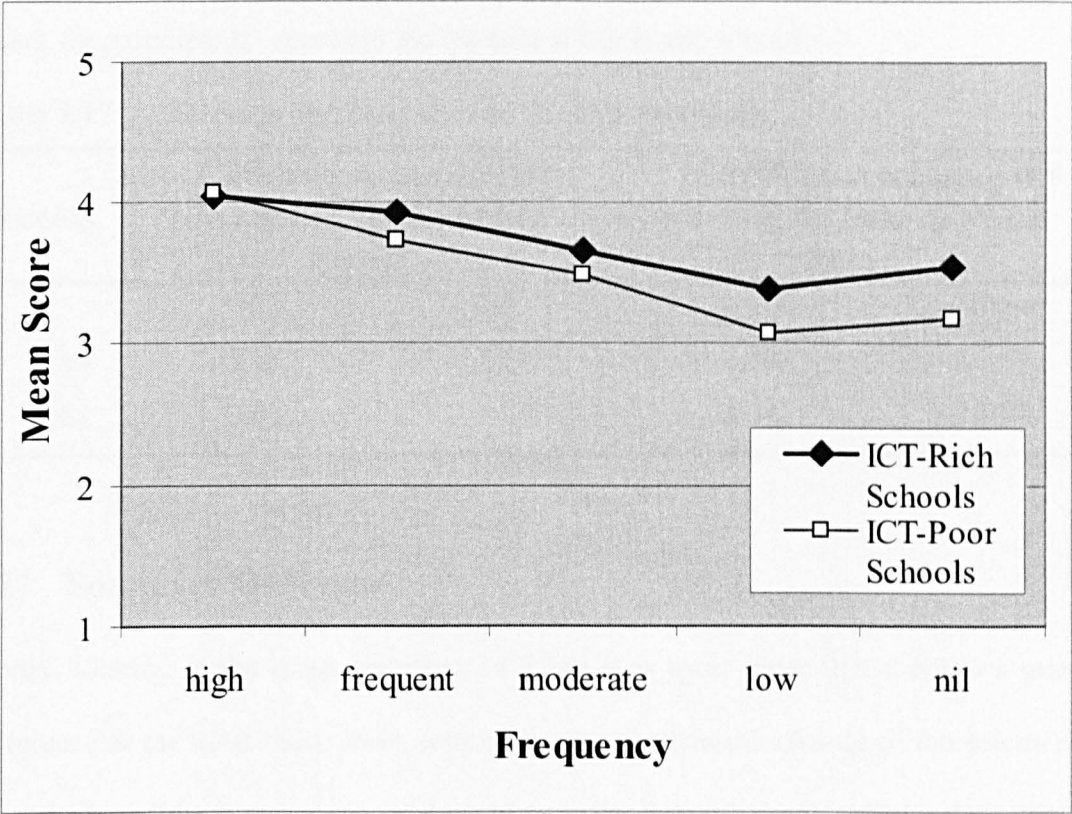


A significant interaction between user level and school type was also found for Internet Confidence, $F=2.92$; $d.f.=4, 709$; $p=0.02$; $\eta_p^2=0.02$. Examination of the means shown in Table 7.16 revealed that children at the ICT-rich schools scored more highly for the PAttI dimension of Internet Confidence, but only where their user level at home fell into the lower categories for frequency of use. Figure 7.15 illustrates this.

Table 7.16 User Level at Home and ICT-rich/ICT-poor school Interaction

User Level at Home	ICT-rich/ICT-poor school	Mean	Std. Error
high	ICT-rich	4.06	.05
	ICT-poor	4.07	.06
frequent	ICT-rich	3.93	.07
	ICT-poor	3.73	.07
moderate	ICT-rich	3.66	.12
	ICT-poor	3.48	.10
low	ICT-rich	3.38	.25
	ICT-poor	3.07	.19
nil	ICT-rich	3.54	.07
	ICT-poor	3.17	.05

Figure 7.15 User Level at Home and ICT-rich/ICT-poor school attended Interaction for Internet Confidence



7.10.4 Participants' Access to the Internet and PAttI Scores

An analysis of variance carried out on the total PAttI score for the girls showed that there was a significant difference between those who were accessing the Internet at home and those who were not, $F = 59.34$; $d.f. = 1,358$; $p = 0.001$; $\eta_p^2 = 0.142$. Examination of the means revealed that girls using the Internet at home achieved higher PAttI scores, with a mean score of 3.54 compared to 3.01. Similarly, an analysis of variance carried on the total PAttI score for the boys showed that there was a significant difference between those who were accessing the Internet at home and those who were not, $F = 64.25$; $d.f. = 1,367$; $p < 0.001$; $\eta_p^2 = 0.149$. Examination of the means showed that

boys who accessed the Internet at home had a mean PAttI score of 3.72, compared to 3.13 for those who did not. Comparable analyses of variance in respect of girls' and boys' access to the Internet at school found no significant differences between those who accessed the Internet at school and those who did not. Table 7.17 presents the mean scores for participants' access to the Internet at home and school.

Table 7.17 Access to the Internet and Mean PAttI Score

Access	Children Accessing the Internet at Home Mean Score		Children Accessing the Internet at School Mean Score	
	Girls	Boys	Girls	Boys
Yes	3.54	3.72	3.50	3.59
No	3.01	3.13	3.34	3.57

7.11 Summary Overview

Firstly, looking at the overt signifiers of PAttI it is quite clear that there is a gender difference at the most basic level, relating to straightforward take-up of the Internet. In the context of the home, 66% of the girls accessed the Internet compared to 74% of boys, a significant difference. The odds of the boys choosing to access the Internet at home or not was nearly 1½ greater than for the girls. This differential was greatly increased in the context of ICT-rich schools, where only 33% of girls chose to make use of the informal facilities, compared to 62% of the boys. The odds of boys reporting that they voluntarily used the Internet at school in their own time were more than three times more likely than the girls. It can be argued therefore that the context of the school, in relation to informal voluntary use of the Internet, is less conducive to participation by the girls.

At home, actual physical access to the Internet was more likely to occur in a family room. However, girls dominated this category, 81% compared to 68% of boys;

whereas nearly a quarter of boys using the Internet at home had access from their own bedroom in contrast to only 8% of the girls. This implies that the degree of physical access to the Internet at home is relatively enhanced for the boys in this study.

In terms of the type of use of the Internet, there were no gender differences in Internet use for school-related work, chatrooms or email in either the context of school or home. There were gender differences in both contexts for games use and WWW-browsing, with boys' frequency of use being greater in each instance. At home, the gender distribution was almost reversed for games use. The boys' distribution for frequency of WWW-browsing was skewed towards the higher categories at school, whereas the girls' distribution was relatively even. One per cent of boys reported never using the Internet at school for WWW-browsing in contrast to 17% of girls. At home, again the boys' distribution for WWW-browsing was skewed towards the more frequent categories of use, with the girls presenting a more symmetrical distribution.

Looking at the question of experience, the boys attending ICT-rich schools were more frequent users of the Internet outside of lessons than the girls. Similarly, looking across all participants at home, boys were again more frequent Internet users. Not only did the boys in this study choose to access the Internet at school in greater numbers than the girls, they were also more frequent users and therefore had relative overall gains in experience.

Next, consideration is focused on the effects of, and possible interactions between, the independent variables: Gender, User Level at Home, User Level at School, ICT-rich/ICT-poor school attended, and the inferred measures of PAttI, the three dimensions of the PAttI scale: Internet Friendship, Internet Confidence and Personal Relevance.

Examination of the psychometric properties of the PAttI instrument established that it successfully demonstrated discriminative validity. Differing scores for the groups were yielded for the groups which could logically be expected to differ in terms of the construct of psychological access to the Internet: gender, experience and context. The internal consistency reliability of the PAttI scale was evidenced by Cronbach's (1951) coefficient alpha, with a range between individual items of 0.85 to 0.87 and an overall alpha of. 0.86.

Principal components analysis identified convergent validity for scale items across three dimensions, thus suggesting three discrete subscales. The sub-scales all had acceptable levels of internal reliability: Internet Confidence $\alpha=0.84$, Personal Relevance of the Internet $\alpha=0.77$, and Internet friendship $\alpha=0.86$. A second-order factor analysis, based on the summed scores of each of the subscales, found one underlying factor, establishing that the PAttI scale was measuring a global construct, investigated and defined by this thesis as psychological access to the Internet.

Looking at children attending an ICT-poor School, examination of the PAttI scores found a main effect of User Level at Home, with all three PAttI dimensions being significant. School attended within this school type, ICT-poor, was not significant and there were no significant interactions. Where children chose to use the Internet at home, the PAttI dimension scores increased with progressive experience. The main effect of user level at home accounted for 14% of the total variability in the PAttI dimensions. User level accounted for 21% of the variation for Internet Friendship, 27% of the variation for Internet confidence, and 12% of the variation for Personal Relevance of the Internet. These are all large effect sizes and offer evidence that the impact of the level of use of the Internet at home by the participants attending the ICT-poor schools in this study was important across all the dimensions of PAttI identified.

Gender was also found to be significant for the PAttI dimension of Personal Relevance of the Internet for children attending an ICT-poor school, with boys' mean scores exceeding those of the girls. An effect size of 1.2% for variability attributable to Gender for Personal Relevance of the Internet was, however, small.

The relationship of the degree of user level at home, to all the PAttI dimensions, establishes the importance of experience with regard to participants' overall scores for this construct. The effect of gender for Personal Relevance of the Internet shows that, for the children attending the ICT-poor Schools, girls are more adversely impacted in terms of their scores for this particular dimension of PAttI, but the overall effect size can be considered small.

For children attending an ICT-rich school, a main effect of user level at home was found. User level at home was significant for all three PAttI dimensions, with overall scores being higher for the more frequented categories of use. The main effect of user level at home accounted for 4% of the total variability in the PAttI dimensions. User level at home accounted for 7% of the variation for Internet Friendship; 4% of the variation for Internet Confidence; and 4% of the variance for Personal Relevance of the Internet. The influence of user level at home for the three PAttI dimensions would be considered as a medium effect. Gender, school attended and user level at school were not significant main effects and there were no significant interactions. Thus it can be concluded that where user level at home is equal amongst this groups of participants, then their gender, school attended and user level at school, make no difference to their PAttI scores; equality of experience at home obviates any effect of gender, school or user level at school.

The participants were next examined as a whole for possible effects and interactions of gender, school type (ICT-rich, ICT-poor), and user level at home, upon all three

dimensions of PAttI. Thus consideration was given to the effect of being a boy or girl; attendance or not at a school with a policy of access to ICT outside of timetabled lessons; and the extent of experience with the Internet in the home context. All the independent variables were found to be significant.

The main effects of gender, ICT-rich/ICT-poor school attended and user level at home, accounted for 3%, 2% and 11% of the total variability respectively in the PAttI dimensions. Gender accounted for 2% of the variance in Internet Confidence and 1% of the variance in Personal Relevance of the Internet, a small effect size in both cases, with boys' scores exceeding girls. ICT-rich/ICT-poor school type attended accounted for 1% of the variability in Internet Confidence, again a small effect size, with greater scores for this dimension when the children attended an ICT-rich school. User level at home accounted for 20% of the variability for Internet Friendship, 19% of the variability for Internet Confidence, and 11% of the variability for Personal Relevance of the Internet, all three indicative of a large effect size, with means scores increasing with frequency of use. An interaction between user level at home and school type, ICT-rich or ICT-poor, accounted for 2% of the variability for Internet Confidence, with children attending ICT-rich schools scoring more highly for the dimension of Internet Confidence, but only where user level at home fell into the lower categories.

In the final analyses, the effect of access to the Internet at home and school upon total PAttI scores was examined. This found that for both girls and boys, access at home was a significant factor, with higher scores resulting for those who did choose to access the Internet. The effect sizes were large, 14% and 15% respectively. Access to the Internet at school for those children attending ICT-rich schools, did not find any significant differences between those who did and did not choose to access the Internet.

7.12 Conclusions and Discussion

The design of this study was intended to examine the effects of gender, Internet experience and context of use, upon psychological access to the Internet. The questions addressed in the final study were firstly those relating to overt behaviours potentially linked to PAttI:

- Is gender an important variable in the take-up of the Internet in informal contexts?
- Is gender an important variable in the type of use of the Internet in informal contexts?
- Is gender an important variable in the extent of use of the Internet in informal contexts?

and secondly, questions to draw out the inferred attitudinal aspects indicative of PAttI:

- Is there an effect of gender on a measure of PAttI?
- Is there an effect of context on a measure of PAttI?
- Is there an effect of experience on a measure of PAttI?

Overt behaviours such as voluntary use of the Internet in informal contexts and the extent and type of that use, were reported by the self-declarations in responses to the survey questionnaire. The inferred aspects of psychological access to the Internet, individuals' attitudes, were drawn out and examined by responses to the items on the PAttI instrument contained in the survey questionnaire.

Gender was found to be an important variable in the take-up of Internet in informal contexts. Examination of the results of the survey showed that the boys were significantly more likely than the girls to make use of the Internet at both school and home in voluntary situations. Boys' access to the Internet in their own bedroom was significantly greater than the girls'. Whether this reflects demands at the level of

individuals' or family perceptions about suitability of access for either gender, is not readily apparent. However, this does lead back to the circularity of the argument to do with relative experience and the impact of this upon attitudes such as confidence.

Gender was also found to be an important variable in the type of use, and extent of use, of the Internet in informal contexts. Boys were more prolific users of the Internet for games and www-browsing, in both informal school contexts and at home. There were however, no significant differences for school-related work, chatrooms or email. The results suggest that there is a gendered use of the Internet in respect of games, reflecting previous research experience with computers and games. In order to allow for the potential influence of gender upon choices of application use, and thus relative experience, the highest degree of experience reported from across the five applications was extracted and taken as representing individuals' experience, defined as user level.

Looking next at the inferred attitudinal aspects indicative of psychological access to the Internet, the PAttI instrument was found to be a reliable measure of the construct intended. Analysis of the PAttI scores found that gender and experience proved to be key main effects for the children in this study; scores for boys and those with greater experience were greater across all three PAttI dimensions. Nevertheless, when experience was equal between the sexes, then an effect of gender was not present.

With regard to context, attendance at either an ICT-rich or ICT-poor school also produced a main effect, with the dimension of 'Internet Confidence' producing higher scores for the former group. An interaction between ICT-rich or ICT-poor type of school attended and user level at home showed that attendance at an ICT-rich school diminished a negative effect upon confidence – but only where experience at home for children attending an ICT-poor school was less. In other words, it was a compensatory factor but not an additive one.

The key issue investigated by this study, psychological access to the Internet, has been found to impact upon equity of participation. Provision of facilities, mandatory participation in educational contexts, does not necessarily mean that individuals are sufficiently engaged with the medium in order to pursue it into their social and professional life. As this thesis has argued previously, this has potentially dire consequences, impacting at both the level of the individual and society.

The generations for whom information technology has been part of their everyday experience whilst growing up are turning to the Internet as a source of information in preference to previously traditional sources, such as newspapers and television. For example, a poll in the USA around the time of the interviews (Cyberatlas, 1998) found that 67% of households which chose the Internet as their main source of information gathering were comprised of those aged 18 to 24. Of these, 59% rated Internet-sourced information as more useful than newspapers and 53% more useful than television. To illustrate further, 84% were more likely to use the Internet than a public library to locate information.

More recently, a survey by the Office for National Statistics found that by October 2004, 52% of households in the UK could access the Internet from home; this compares with 9% in October 1998 (National Statistics, 2005a). Sixty-one per cent of the adults surveyed had used the Internet in the previous three months, with 55% purchasing or ordering goods, tickets or services online.

These figures illustrated the growing importance of the Internet as a source of information, consumer activity and communication. The British government policy to implement the National Grid for Learning was a move towards capturing and utilising the best features of the medium in education.

The question arises of what impact gender will have upon individuals' voluntary access to the Internet. Previously, research has indicated a lack of psychological access to IT by girls, which has shown itself in situations where physical access is informal and voluntary, resulting in a relative lack of participation compared to boys. This potentially has an effect on the possible gains to be had from such experience, particularly in terms of experience and confidence.

This study has shown that girls' lack of psychological engagement with the Internet is apparent in their choices about whether to voluntarily use it in informal contexts. Moreover, the effect of the school context has been shown to impact even more negatively upon girls' voluntary participation in comparison to boys.

Examination of the PAttI measures revealed that the subscale of Internet Confidence and Personal Relevance of the Internet, showed a significant but small effect of gender; girls' scores were lower than the boys. This suggests that not only is there a dimension of personal confidence influencing matters differently between the sexes, but also a dimension of perceived personal relevance of the Internet. It can be argued therefore that a policy to increase individuals' sense of personal relevance with regard to the Internet could have particularly beneficial effects in the case of girls. Although both the effect sizes for these dimensions are small, the outcomes when considered in terms of the population of study, schoolchildren in the UK, are potentially considerable.

Confidence as a dimension of PAttI was also significant for the type of school attended, ICT-rich or ICT-poor. Children at ICT-poor schools, defined as those without a policy to allow children to use the Internet outside of timetabled lessons, scored lower. Again, whilst the effect size is small, the outcome when considered in terms of the overall population indicates a degree of importance for this issue. Although the definition of school type by informal ICT provision for this study was relatively

simplistic, it could sensibly be argued to reflect a range of influences and attitudes at school level; for example, how innovative and positive a school's ICT planning are, staff capabilities, and the enthusiasm of the school leadership to support ICT use and development.

The degree of home experience for use of the Internet was revealed to be a significant effect for all three dimensions of PAttI, producing large effect sizes. Amongst individuals identifying themselves as using the Internet at home, the scores rose with increasing levels of use. Interestingly, for those children declaring a 'nil' use of the Internet at home, the scores were all marginally higher than for those reporting a 'low' use. The reasons for this are not readily apparent, although it could be argued that those stating a low use had adjusted their PAttI judgements about themselves to a lesser, perhaps more accurate, level. In other words, their personal benchmark had altered.

The crucial role of experience for gains in psychological access to the Internet across all three dimensions of the PAttI measure has been demonstrated, proving greater than the individual effects of gender or type of school context. Looking more closely at the relationship of experience (user level) with the three dimensions, the greatest effect size was for Internet Friendship, 20%. This suggests that social aspects and influences are only marginally more critical than Internet Confidence, 19%. Personal Relevance of the Internet also showed a large size effect, 11%, for experience, implying that experience was related to an increase in the perception of personal relevance.

Previous research in the field has identified many aspects of the attitudinal structures argued to relate to gender and ICT, for example confidence and anxiety, self-efficacy, context, and gender stereotyping. The impact of experience has also been identified as a factor of major importance, with prior experience being argued to mediate the effect of gender. However, a key issue, in respect of much of the *voluntary* nature of gaining

experience in the first place, has not been addressed. In the course of work for this thesis, the relationship of gender and the Internet in formal and informal contexts has been effectively examined, with detailed consideration and analysis given to the relative impact of context and voluntary experience upon gender and PAttI. What has also become apparent from the studies for this thesis is the multidimensional nature of the construct, here defined, developed and measured, as PAttI.

The PAttI measure successfully captured the proposed psychological construct and revealed three crucial contributing dimensions. The PAttI measure also demonstrated the relative importance of context, experience, and gender - with experience proving to be the component of main importance and showing that experience and gender are acting independently. When experience levels with regard to use of the Internet at home are equivalent between individuals, then gender does not contribute to the variance in scores.

Given that explicit voluntary access to the Internet at home and at school has been shown to be statistically significantly different between the boys and girls in this study, with boys' access being far greater, the question to be resolved is how to ensure that equity of physical access occurs. The importance of this was shown by the significance of access upon the overall PAttI scores; both girls and boys with access to the Internet at home scored significantly higher than those who did not. But, when it is considered that the boys in this study were more than three times more likely than the girls to have such access, then the implications for the girls in terms of physical and psychological access to the Internet are inequitable.

The PAttI measure has provided an indication of the components that are most likely to impact upon girls' willingness to interact with the Internet, in respect of

confidence and perceived personal relevance. Yet, even with experience in mandatory school contexts, girls still choose to opt out in voluntary situations.

CHAPTER EIGHT

8 CONCLUSIONS

8.1 Introduction

This chapter summarises the primary achievements of the research presented in this thesis, answering the research question:

Will the inequity of psychological access demonstrated in a substantial body of research into gender differences in attitudes and computers in education, be repeated in relation to adolescents' use of the Internet?

The implications that this work has for research, education and policy are considered. The limitations of the research are also outlined. Potential improvements for the PAttI measure are considered and possible future research efforts are proposed.

8.2 Achievements

The research described in this thesis is concerned with the conceptualisation and measurement of the construct delineated by this work as *psychological access to the Internet*. This research has several achievements:

- The exploration and conceptualisation of the PAttI construct
- Establishment of the multidimensional nature of PAttI
- The development of an instrument to measure individuals' PAttI with discriminative validity
- The identification of components contributing to PAttI
- The application and testing of the PAttI instrument in real-life voluntary contexts, investigating relationships with gender and experience.
- Establishment of relative contributions of individual PAttI components
- Extended previous work in the field

- Addressed previous gaps identified in the field

Chapter 2 reviewed the literature on gender, attitudes and ICT, identifying inequities of participation, physically and psychologically. From the literature it was concluded that provision of equal physical access to ICT in education is only a partial solution to such inequities, and identified the importance of psychological access. The significance of this was indicated in terms of educational participation, achievement and the fulfilment of professional potential.

The review of the literature resulted in the proposition that girls are disadvantaged in achieving psychological access to computers, for example through negative attitudes and a lack of confidence. However, the review also identified that when compelled to participate girls prove equally competent, suggesting that experience mediates the impact of gender. The difficulty appears to be in encouraging them to participate willingly in the first instance.

The research literature also indicated a divergence in perceptions of desirable use of ICT between the sexes; this was flagged as being a possible indication that the route to psychological access may be found through consideration of the context of use and of the possible relevance and impact of this.

In view of the increasing importance and relevance of ICT for education in the United Kingdom the review raised the question driving research for this thesis, of whether a distinct lack of psychological access by girls to computers *per se* observed in previous research would transfer to the primary medium of ICT, the Internet.

The research for this thesis therefore set out to explore and define the components proposed as contributing to PAttI. This was achieved by a triangulation of methods

involving observation, interviews and survey, and was grounded in the real-life everyday contexts of adolescent children.

The concurrent development and refinement of an instrument with which to measure PAttI was finally tested in a major survey designed to examine the relative impact of gender, Internet experience and use, and the differing informal contexts available at home and school. The research design was intended to focus upon situations where physical access was voluntary and thus draw out a clearer picture of the relationships between gender, experience, type of use and context of use.

The work for this thesis has therefore added to the body of research cited in Chapter 2 in several specific ways. An underlying psychological construct, PAttI, found to relate to individuals' voluntary interaction with the Internet has been proposed; the contributing components documented; and an appropriate measure of the construct has been developed and tested. The relative effects of gender, experience and contexts, previously an area of overlap and confusion in some studies, have been clearly demarked and tested. A key contribution offered by this thesis is the multidimensional nature of PAttI, which offers a better understanding of the effects of gender, context and experience on PAttI. The main findings which contribute towards the body of knowledge in this area can therefore be summarised as follows.

Gender has been shown to be an important variable in *voluntary* engagement with the Internet. Boys' access exceeded girls, both at home and in informal, ICT-rich, school situations. At home, boys were more likely to have Internet access in their bedroom in comparison with girls. Boys were also found to be more prolific users of the Internet in both contexts, but particularly at school, in comparison to girls' use.

With regard to overall experience with Internet use, boys were more frequent users of the Internet at home and school. The effect of gender was also found to be significant

for certain types of Internet use. WWW-browsing and Internet games were more frequently used applications for boys than girls; e-mail, chatrooms and school-related work were not differentiated by gender. This finding was consistent at home and school.

Overall, the structure and design of the work for this thesis dissected potentially confounding aspects identified in prior research as impacting upon gender and attitudes towards computers, such as context and experience, and successfully enabled their relative role and contribution towards a unique multidimensional construct of PAttI to become clear.

The PAttI measure, developed over the course of the work for this thesis, was applied in relation to the key variables of gender, context, and experience. Of particular importance here was the consideration given to differing voluntary contexts and relative experience. This, together with the analysis of the effects upon individual components, enabled a detailed consideration of the relative effects of factors upon PAttI. To illustrate, gender, type of school attended and experience at home, were all significant multivariate main effects. However, gender was specifically significant for Internet Confidence and Personal Relevance of the Internet, with boys' scores being higher. Type of school attended was significant for Internet Confidence only, with participants attending an ICT-rich school scoring higher here; and experience at home was significant for all three dimensions, with scores increasing with frequency of use.

Critically, the work for this thesis also identified the impact of voluntary access at home and school upon total PAttI scores within the sexes. There was no significant difference for overall PAttI scores between ICT-rich and ICT-poor schools, within the sexes. Girls accessing the Internet at home however, scored higher than those who did not, producing a large size effect. Similar results were found for the boys. Since girls were significantly less likely to be in the group who do voluntarily access the Internet at

home this perhaps isolates the root of concerns; how can girls be enabled to gain both physical and psychological access?

The review of the research literature in Chapter 2 argued that a substantial body of research into gender differences in attitudes and computers had demonstrated an inequity of what has been termed by this thesis as psychological access, favouring boys and men. This provoked the question of whether an inequity of psychological access would be repeated in relation to adolescents' use of the Internet, rather than simply computers *per se*. The work for this thesis has successfully identified psychological access as a central factor in adolescents' voluntary engagement with the Internet, investigated the components involved and developed a survey instrument to measure PAttI, and offered further insight into a construct which has been shown to be multidimensional. Table 8.1 presents the attitudinal items from the survey instrument, indicating the three factor-based scales found to contribute towards the overall global measure of PAttI.

Table 8.1 Psychological Access to the Internet Questionnaire

Questionnaire Item:		Scale*
1.	Most of my friends don't use the Internet	<i>b</i>
2.	I don't want to have the Internet in my home when I grow up	<i>b</i>
3.	The Internet has lots of interesting sites for me	<i>b</i>
4.	I am not very good at using the Internet	<i>a</i>
5.	I like to use the Internet	<i>a</i>
6.	The Internet is safe to use	<i>a</i>
7.	I don't want to use the Internet	<i>b</i>
8.	The Internet is difficult to use	<i>a</i>
9.	I feel confident using the Internet	<i>a</i>
10.	I don't find many interesting sites on the Internet	<i>b</i>
11.	I have made new friends on the Internet	<i>c</i>
12.	I would like to use the Internet in my future work	<i>b</i>
13.	I am good at using the Internet	<i>a</i>
14.	I don't want to use the Internet in my future work	<i>b</i>
15.	I would like to have the Internet in my own home when I grow up	<i>b</i>
16.	I haven't made any new friends on the Internet	<i>c</i>
17.	I feel nervous using computers at school	<i>a</i>
18.	The Internet is easy to use	<i>a</i>

* *a* = Internet Confidence; *b* = Personal Relevance of the Internet; *c* = Internet Friendship

8.3 Implications for Education

The empirical work carried out for this thesis indicates that PAttI is an important factor in children's take-up of voluntary interactions with the Internet, and this has implications in terms of experience, participation, and subsequent educational and professional achievement. Voluntary experience was found to be the over-riding influence on measures of PAttI, followed by gender and then context. In education this implies that girls' academic achievement in ICT will continue to experience the attrition previously observed in their progressive withdrawal as diminishing levels of compulsion are reached.

Education in the United Kingdom is rapidly becoming orientated towards delivery and content that is dependent on ICT. Whereas previously, an individual's decision to opt out of participation in this area may have simply meant a lack of qualification in Information Technology, now the implications are far wider. Not only is a potential lack of engagement by such individuals indicated by an inequity of PAttI, but an impact upon educational outcomes has the potential to be far greater than before.

The implications arising from this thesis in respect of education suggest that the relative lack of psychological access, initially identified in the review of the literature primarily based on computer research, is therefore now of even more serious and immediate concern.

Findings from the work for this thesis suggest some valuable starting points for research which addresses this concern; in particular, investigation into issues found to be inequitably impacting girls including perceived personal relevance, the impact of stereotypes, style of curriculum content, and the social context of the classroom.

8.4 Implications for Policy

Chapter 2 outlined the policy developments underpinning the rapid development and growth of ICT provision in United Kingdom education since 1997. Policy has focussed upon providing the infrastructure, connectivity, and more latterly the content, for education based around ICT. What policy has failed to do so far with regard to this agenda is consider the contribution that the individual learner brings to this particular educational situation. It is analogous to a SimCity simulation in which roads, facilities and institutions have been built without consideration of the variable nature of the occupiers. The perception by individuals of the personal relevance of the context, content and provision, their confidence, attitudes and inclination to take up the provisions, have yet to be factored into the equation for successful outcomes.

The work for this thesis indicates that PAttI is of direct importance and relevance to individuals' voluntary interaction with ICT. The findings offer further weight to Littleton and Hoyles (2002) argument for epistemological pluralism and the integration of ICT into education as a tool that is available for use as and when appropriate. The continuing relevance of the findings from the work for this thesis can be seen in reference to the current Government policy relating to the use of ICT in education. The Government's major e-strategy paper, *Harnessing Technology: Transforming Learning and Children's Services* (DfES, 2005a) highlights a continuing commitment to ICT in education. Access to online information is prioritised in the report and schools are to be encouraged to use online networks to provide parents with information. In effect, this means secure access to their child's progress, attendance, and other more generalised information such as timetables and communicating with staff. The next relevant priority relates to personalised support for learners, with online learning space to be provided for learners in order to develop what is effectively an electronic portfolio. The third priority

is to accelerate progress towards the next generation of e-learning activities and resources. All of these areas require access to the delivery medium: the Internet. They also presuppose equity of access.

Although *Harnessing Technology: Transforming Learning and Children's Services*, (DfES, 2005a) does address the importance of the digital divide, this is mainly focused upon equity issues relating to socioeconomics. Access, at the level of the individual, relating to their predisposition to engage voluntarily with the Internet, along with attitudes and behavioural intentions, are not taken account of. In short, the effect of PAttI, in terms of equitable participation and outcomes, has not yet been recognised as a factor of importance. The implications of the work for this thesis suggest that such recognition is going to be the next crucial step for policy if equity of educational participation and outcome are to be aimed for.

Recognition of the importance of PAttI, and policy to take account of it, could be operationalised through several key modes, three of which are speculated as follows. Firstly, at the level of the individual, the increasing emphasis upon the personalisation of learning immediately lends itself to the potential for providing varying routes to achievement. Consideration of the gendered nature of some existing approaches within lesson delivery, for example, could promote useful challenges to teachers and enable them to consider appropriate individual variation. Alongside this, an active programme to broaden children's perceptions of ICT in relation to their own personal lives and career aspirations, including presenting challenges to stereotypes held by families, peers and presented in the media, would be useful. Lastly, recognition of the impact of the classroom context upon individuals' potential and desire to engage with certain subject areas, in this case girls engaging with ICT, would usefully generate an impetus to explore alternatives and remedies.

8.5 Limitations of the Research

In the exploratory study described in Chapter 4, observations complemented by informal interviews with children were restricted to one school. The quality and range of the data could have inevitably been improved by comparing and contrasting data from a wider selection of schools and circumstances. Other potential limitations of the study relate to the possibility of an influence upon children's behaviours and responses to questions, arising from a reaction to the person of the actual researcher although every attempt was made to put the children at ease.

The investigative study, Chapter 5, served a useful purpose in further exploring and identifying probable candidates for components contributing towards PAttI. The attitudinal scale however contained a flaw in relation to the wording of gender-specific statements, which failed to contribute acceptably towards the scale's reliability. The conclusion reached was that the most likely reason was the use of 'Boys' or 'Girls' in the wording confounded the results and that a more indirect phrasing, which could then be related to the gender of the respondent, might have been more productive. It was argued that this could be indicative of an effect due the 'We can, I can't' paradox (Collis, 1885) confounding responses.

The Interview study presented in Chapter 5 was based upon interviews with 30 pupils. Of these, 25 were volunteers from the investigative survey. However, one specific group failed to put forward any volunteers and had to be directly requested to take part. This was the Year 10 girls' group. It seems likely that this circumstance was of relevance and interest to the work for this thesis, but it was not practicable at the time to follow this up. The aspect that is particularly interesting is that given a direct choice to opt-in to a situation talking about the Internet, they declined to do so, whereas their male peers and younger girls volunteered in equal measure. Previous research has

indicated a gender effect emerging with adolescence (Brosnan, 1998b; Colley & Comber, 2003; Comber, Colley, Hargreaves, & Dorn, 1997; King, Bond, & Blandford, 2002; Lage, 1991; Measor, 1984; Todman, 2002). An investigation into the underlying reasons for this particular occurrence in the Interview Study may have been able to offer a significant contribution to the development and refinement of the conceptualisation of the PAttI construct.

The main study, although drawing across four schools, was specific to a geographical region of the United Kingdom. In order to establish the wider reliability of the PAttI instrument, it would need to be applied to other Year 10 children covering a wider geographical area and perhaps with greater socio-economic variation. Although there was a degree of socio-economic variation anecdotally observed between the schools, this cannot be presented as an objective measure; Ofsted reports, using entitlement to free school dinners as an indicator of relative deprivation for example, show that none of the schools fell below national averages.

A further limitation of the final study rests in the scope and length of the measure. A wider range of questions relating to the key themes identified from the investigative and interview studies could have made a more worthy contribution to the final instrument, and therefore to the degree of validity and reliability with which it may be viewed and tested in replication studies. Against this however, must be offset the practicalities of applying the instrument in real-everyday contexts such as within school lessons, where the potential for individual concentration and the duration available for applying a survey instrument may not be ideal.

8.6 Further Research

The findings of this thesis indicate that boys are more likely than girls to make use of the Internet in voluntary situations at both school and home; this reflects previous

research findings in respect of gender and experience with computers *per se*. A gendered use of the Internet in respect of games and WWW-browsing is also apparent, again reflecting previous research relating to gendered use of computers. Given the rapid expansion of web-based media experiences into new representations such as blogs, podcasting, real-time voice communications, creative collaborations and many more examples, research into gender, experience and type of Internet use is worthy of being revisited. More detailed focus and analysis here will enable the development, and possible variation, of Internet uptake and use between the sexes to be mapped and the emerging implications considered. An in-depth qualitative study in a very holistic tradition, for example an ethnographic approach, would perhaps add more colour and depth.

This work has shown that the impact of context upon voluntary use is one of relative negativity for girls compared to boys, with far less participation in both informal home and school contexts; however, the voluntary use of the Internet at school for girls is noticeably less for them than at home. The significance of context merits further investigation. Even when girls and boys are matched for equality of voluntary access at home, this degree of similarity fails to be reproduced in the voluntary school context. To establish the underlying reasons for this would require a major examination of the variables at work in the two contexts in relation to gender.

The PAttI instrument itself identified three key components contributing towards a global PAttI score: Internet Confidence, Perceived Relevance, and Internet Friendship. Gender, ICT-rich/ICT-poor school attended, and user level at home were all found to be significant multivariate effects; however, there were differences to be found at univariate level. The availability of voluntary use in schools was found to be an important variable, with ICT-rich schools demonstrating a compensatory element in

respect of Internet Confidence for those children with less Internet experience at home. Gender was implicated for the variables of Internet Confidence and Personal Relevance, with girls scoring less. Experience was found to be a significant factor for all three dimensions of PAttI. These outcomes imply the following for further research:

- The need to identify the aspects of voluntary use at school which make it attractive/ unattractive to equal participation by girls. It can be proposed that aspects of confidence and perceived personal relevance will offer a useful initial focus.
- Experience is the key factor for PAttI; how voluntary experience can be encouraged beyond mandatory requirements requires exploration.
- Identification of the components contributing towards increased confidence by children at ICT-rich schools; confidence was found in this work to compensate for home deficits. Research here would enable recommendations to be made benefiting those schools lacking the same degree of provision.

8.7 Summary

This final chapter has outlined the main achievements of the research contributing towards this thesis. These have encompassed: the conceptualisation of a psychological construct designated in this thesis as *Psychological Access to the Internet*; exploration and identification of the components contributing towards the construct, grounded in the real-everyday contexts of adolescent children; and the development, refinement and testing of an instrument to measure PAttI.

Nearly a decade ago, the first foundations of an ICT infrastructure were laid down. This has rapidly progressed alongside developments in content, applications and the potential for interactive learning. The effect of the digital divide has for the most part

been solely recognised in terms of economic participation; the work for this thesis has shown the relevance of a divide at the level of individual, psychological attitudes. It can be argued that it is this issue that will next require the attention of researchers and policy makers if equity of psychological access to the Internet in education by adolescent boys and girls is to be achieved.

REFERENCES

- AdRelevance.com. (2000). *Wired Women*. Retrieved 2nd November, 2005, from http://www.adrelevance.com/intelligence/intel1_17_00.pdf
- Allport, G. W. (1954). *The Nature of Prejudice*. Reading, MA: Addison-Wesley.
- Arch, E. C., & Cummins, D. E. (1989). Structured and unstructured exposure to computers: Sex differences in attitude and use among college students. *Sex Roles*, 20(5/6), pp. 245-254.
- Archer, J., & Macrae, M. (1991). Gender perceptions of schools subjects among 10-11 Year Olds. *British Journal of Educational Psychology*, 61, 99-103.
- Arenz, B. W., & Lee, M. J. (1990). *Gender differences in the attitude, interest and participation of secondary students in computer use*. Paper presented at the Annual Meeting of the American Educational Research Association, Boston, Massachusetts.
- Bandura, A. (1986). *Social foundations of thought and action: A social-cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Barba, R. H. (1990). Assessing children's attitudes towards computers: The draw-a-computer user test. *Journal of Computing in Childhood Education*, 2(1), 5-17.
- Barbieri, M. S., & Light, P. (1992). Interaction, gender and performance on a computer-based problem solving task. *Learning and Instruction*, 2, 199-213.
- Bem, S. L. (1993). *Lenses of Gender: Transforming the debate on Sexual Inequality*. New Haven, CT: Yale University Press.
- Berkowitz, S. (1997). *Analyzing Qualitative Data*. In J. Frechtling, L. Sharp, and Westat (Eds.), *User-Friendly Handbook for Mixed Method Evaluations*. Retrieved 2nd

November, 2005, from http://www.ehr.nsf.gov/EHR/REC/pubs/NSF97-153/CHAP_4.HTM

- Beyer, S., Rynes, K., Chavez, M., Hay, K., & Perrault, J. (2002). *Gender differences in computer science students*. Paper presented at the Technical Symposium on Computer Science Education. Proceedings of the 34th SIGCSE technical symposium on Computer science education.
- Biernat, M., Manis, M., & Nelson, T. E. (1991). Stereotypes and standards of judgment. *Journal of Personality and Social Psychology*, 60, 485-499.
- Bodenhausen, G. V. (1988). Stereotypic biases in social decision-making and memory testing process models of stereotypes use. *Journal of Personality and Social Psychology*, 55(5), 726-737.
- Breckler, S. J. (1984). Empirical validation of affect, behavior, and cognition as distinct components of attitude. *Journal of Personality and Social Psychology*, 47, 1191-1205.
- British Educational Research Association: Ethical Guidelines*. (1992). Retrieved 12th December 2005, from <http://www.bera.ac.uk/guidelines.html>
- Brosnan, M.J. (1994). Computer Phobia: Is it a particularly female phenomenon? *The Psychologist*, 7, 73-78.
- Brosnan, M. J. (1998a). The impact of computer anxiety and self-efficacy upon performance. *Journal of Computer Assisted Learning*, 14, 223-234.
- Brosnan, M. J. (1998b). The impact of psychological gender, gender-related perceptions, significant others, and the introducer of technology upon computer anxiety in students. *Journal of Educational Computing Research*, 18(1), 63-78.

- Brosnan, M. J. (1999). A new methodology, an old story? Gender differences in the "draw-a-computer- user" test. *European Journal of Psychology of Education, XIV*(3), 375-385.
- Camp, T. (1997). The incredible shrinking pipeline. *Communications of the ACM, 40*(10), pp. 103-110.
- Campbell, N. J. (1989). Computer anxiety of rural, middle, and secondary school students. *Journal of Educational Computing Research, 5*, 213-222.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, New Jersey: Erlbaum.
- Computer Clubs for Girls (CC4G). (2002). Retrieved 9th November, 2005, from <http://www.cc4g.net/>
- Chen, M. (1986). Gender and computers: The beneficial effects of experience on attitudes. *Journal of Educational Computing Research, 2*(3), 265-282.
- Cliff, N. J. (1988). The eigenvalues-greater-than-one rule and the reliability of components. *Psychological Bulletin, 103*, 276-279.
- Cockcroft, R. (1982). *Mathematics Counts*. London: Her Majesty's Stationary Office.
- Cohen, J. (1973). Eta-squared and partial eta-squared in fixed factor ANOVA designs. *Educational and Psychological Measurement, 33*, 107-112.
- Colbourn, C. J., & Light, P. H. (1987). Social interaction and learning using micro-PROLOG. *Journal of Computer Assisted Learning, 3*, 130-140.
- Colley, A., & Comber, C. (2003). Age and gender differences in computer use and attitudes among secondary school students: what has changed? *Educational Research, 45*(2), 155-165.

- Colley, A. M., Gale, M. T., & Harris, T. A. (1994). Effects of Gender Role Identity and Experience on Computer Attitude Components. *Journal of Educational Computing Research*, 10(2), 129-137.
- Collis, B. (1985). Psychosocial implications of sex differences in attitudes towards computers: Results of a survey. *International Journal of Women's Studies*, 8(3), 207-213.
- Comber, C., Colley, A., Hargreaves, D. J., & Dorn, L. (1997). The effects of age, gender and computer experience upon computer attitudes. *Educational Research*, 39(2), 123-133.
- Crawford, M., & Chaffin, R. (1997). The meanings of difference: Cognition in social and cultural context. In P. J. Caplin, M. Crawford, J. Shibley Hyde & J. T. E. Richardson (Eds.), *Gender Differences in Human Cognition*. New York: Oxford University Press.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.
- Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*(52), 281-302.
- Culley, L. (1988). Girls, boys and computers. *Educational Studies*, 14(1), 3-8.
- Culley, L. (1998). Gender equity and computing in secondary schools: Issues and strategies for teachers. In J. Beynon & H. Mackay (Eds.), *Computers into classrooms: More questions than answers*. (pp. 147-159). London: Falmer Press.
- Cyberatlas. (1998). *Market Usage*, 1998, from http://www.cyberatlas.com/market/usage/web_displaces_activities.html
- Dain, J. (1991). Women and computing: some responses to falling numbers in higher education. *Women's Studies International Forum*, 14(3), 217-225.

- Deaux, K., & Kite, M. (1993). *Gender Stereotypes*. Westport, CT: Greenwood Press.
- Denzin, N. K. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods*. New York: McGraw-Hill.
- Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, 65, 5-18.
- DfEE. (1997a). *Connecting the Learning Society, National Grid for Learning: The Government's Consultation Paper*. Retrieved 28th September, 2005, from http://www.dfes.gov.uk/consultations/downloadableDocs/42_1.pdf
- DfEE. (1997b). *Statistical Bulletin: Survey of Information Technology in Schools 199*. London: Her Majesty's Stationary Office.
- DfEE. (1998). *Statistical Bulletin: Survey of Information Technology in Schools 1998*. London: Her Majesty's Stationary Office.
- DfES. (2002a). *Survey of Information and Communications Technology in Schools 2002*. Retrieved 22nd August, 2005, from <http://www.dfes.gov.uk/rsgateway/DB/SBU/b000360/sb07-2002.pdf>
- DfES. (2002b). *Transforming the way we learn : a vision for the future of ICT in schools*. Retrieved 12th January, 2002, from <http://www.dfes.gov.uk/ictfutures/ictfutures.pdf>
- DfES. (2003). *Survey of Informations and Communications Technology in Schools 2003*. Retrieved 22nd August, 2005, from <http://www.dfes.gov.uk/rsgateway/DB/SBU/b000421/bweb05-2003.pdf>
- DfES. (2004a). *Information and Communications Technology in Schools in England: 2004 (Provisional)*. Retrieved 22nd August, 2005, from <http://www.dfes.gov.uk/rsgateway/DB/SFR/s000480/SFR27-2004v6.pdf>

- DfES. (2004b). *Pupil Achievement Tracker: Key Stage 3*. Retrieved 27th July, 2005, from <http://www.standards.dfes.gov.uk/performance>
- DfES. (2005a). *Harnessing Technology: Transforming Learning and Children's Services*. Retrieved 28th September, 2005, from <http://www.dfes.gov.uk/publications/e-strategy/docs/e-strategy.pdf>
- DfES. (2005b). *Statistical Bulletins*. Retrieved 22nd August, 2005, from <http://www.dfes.gov.uk/rsgateway/DB/SBU/index.shtml>
- Durndell, A., Glissov, P., & Siann, G. (1990). Gender differences and computing in course choice at entry into higher education. *British Educational Research Journal*, 16(2), 149-162.
- Durndell, A., Glissov, P., & Siann, G. (1995). Gender and computing: Persisting differences. *Educational Research*, 37(3), 219-227.
- Eagley, A. H., & Chaiken, S. (1998). Attitude Structure and Function. In D. T. Gilbert, S. T. Fiske & L. Gardner (Eds.), *The Handbook of Social Psychology* (Vol. 1, pp. 269-322). New York: Oxford University Press.
- Eastman, S., & Krendl, K. (1987). Computers and gender: Differential effects of electronic search on students' achievement and attitudes. *Journal of Research and Development in Education*, 20(3), 41-48.
- EOC. (2002). *Facts About Women and Men in Great Britain 2002*. Retrieved 22nd August, 2002, from <http://www.eoc.org.uk/EOCeng/EOCcs/Research/factsgreatbritain2002.pdf>
- e-skills. (2005). Retrieved 9th November, 2005, from http://www.e-skills.com/exchange/CLIENT/about_cc4g.html

- Facer, K., Furlong, J., Furlong, R., & Sutherland, R. (2003). *Screenplay: Children and Computing in the Home*. London: Routledge Falmer.
- Field, A. (2000). *Discovering Statistics using SPSS for Windows*. London: Sage.
- Fishbein, M., & Ajzen, I. (1974). Attitudes towards objects as predictors of single and multiple behavioral criteria. *Psychological Review*, 81, 59-74.
- Fiske, S. T., & Stevens, L. E. (1993). What's so special about sex? Gender stereotyping and discrimination. In S. Oskamp & M. Costanzo (Eds.), *Gender Issues in Contemporary Society: Applied Social Psychology Annual* (Vol. 9, pp. 173-196). Newbury Park, CA: Sage.
- Fletcher-Flinn, C. M., & Suddendorf, T. (1996). Computer attitudes, gender and exploratory behavior: A developmental study. *Journal of Educational Computing Research*, 15(4), 369-392.
- Fallows, D. (2005). *Pew Internet & American Life Survey: How Women and Men Use the Internet*. Washington, D.C.
- Frenkel, K. A. (1990). Women and computing. *Communications of the ACM*, 33(11), 34-46.
- Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New York: Aldine Publishing Company.
- Goodenough, F. L. (1926). *The Measurement of Intelligence by Drawings*. New York: World Books.
- Greenfield, S., Peters, J., Lane, N., Rees, T., & Samuels, G. (2002). *SET FAIR. A Report on Women in Science, Engineering, and Technology from The Baroness Greenfield CBE*,

to the Secretary of State for Trade and Industry. London: Department of Trade and Industry.

Griffiths, M. (1993). Are computer games bad for children? *The Psychologist*, September, 401-407.

Hamilton, D. L., Stroessner, S. J., & Driscoll, D. M. (1994). Social cognition and the study of stereotyping. In P. G. Devine, D. L. Hamilton & T. M. Ostrom (Eds.), *Social Cognition: Impact on Social Psychology* (pp. 291-321). San Diego, CA: Academic Press.

Harris, D. B. (1963). *Children's Drawings as Measures of Intellectual Maturity: a Revision and Extension of the Goodenough Draw-a-Man Test*. New York: Harcourt Brace.

Hayward, B., Alty, C., Pearson, S., & Martin, C. (2002). *Young people and ICT 2002. Findings from a survey conducted in Autumn 2002* (ICT in Schools Research and Evaluation Series No. 12): Produced by Becta for the Department for Education and Skills.

Hennessy, S. (1999). The potential of portable technologies for supporting graphing investigations. *British Journal of Educational Technology*, 30(1), 57-60.

HESA. (2003). *Students in Higher Education Institutions 1999/2000*. Retrieved 21st November, 2002, from <http://www.hesa.ac.uk/holisdocs/pubinfo/student/subject01.htm>

Holloway, S. L., Valentine, G., & Bingham, N. (2000). Institutionalising technologies: masculinities, femininities and the heterosexual economy of the IT classroom. *Environment and Planning A*, 32, 617-633.

Howlett Sunley, T., & Inman, P. (2003). *The Autumn Schools Project - Preliminary Study into the impact of Broadband in the Classroom, Internal report to DfES*. Coventry: Becta.

Jackson, L. A., Ervin, K. S., Gardner, P. D., & Schmitt, N. (2001). Gender and the Internet: Women Communicating and Men Searching. *Sex Roles*, 44(5/6), 363-379.

- Joiner, R. W. (1998). The effect of gender on children's software preferences. *Journal of Computer Assisted Learning*, 14, 195-198.
- Judd, C. M., & McClelland, G. H. (1998). Measurement. In D. T. Gilbert, S. T. Fiske & L. Gardner (Eds.), *The Handbook of Social Psychology* (Vol. 1, pp. 180-232). New York: Oxford University Press.
- Kaye, R. (1992). An analysis of methods used to examine gender differences in computer-related behaviour. *Journal of Educational Computing Research*, 8(3), 277-290.
- Keough, T., Barnes, P., Joiner, R., & Littleton, K. (2000). Gender, pair composition and computer versus paper presentations of an English language task. *Educational Psychology*, 20(1), 33-43.
- Kiesler, S., Sproull, L., & Eccles, J. (1985). Pool halls, chips, and war games: Women in the culture of computing. *Psychology of Women Quarterly*, 9, 451-462.
- King, J., Bond, T., & Blandford, S. (2002). An investigation of computer anxiety by gender and grade. *Computers in Human Behaviour*, 18(1), 69-84.
- Kirriemuir, J., Ceangal, & McFarlane, A. (2004). *Literature Review in Games and Learning*. Retrieved 14th October, 2005, from http://www.nestafuturelab.org/download/pdfs/research/lit_reviews/Games_Review1.p
- Kline, P. (1994). *An Easy Guide to Factor Analysis*. New York: Routledge.
- Koohang, A. A. (1986). Effects of age, gender, college status, and computer experience on attitudes toward library computer systems. *Library and Information Science Research*, 8, 349-355.
- Kraut, R., Scherlis, W., Mukhopadhyay, T., & Manning, J. K., S. (1996). The HomeNet field trial of residential Internet services. *Communications of the ACM*, 39, 55-63.

- Lage, E. (1991). Boys, girls, and microcomputing. *European Journal of Psychosociology of Education, 6*, 29-44.
- Landis, J. R., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174.
- Leathwood, C. (1999). Technological futures: Gendered visions of learning? *Research in Post-Compulsory Education, 4*, 5-22.
- Levin, T., & Gordon, C. (1989). Effect of gender and computing experience on attitudes toward computers. *Journal of Educational Computing Research, 5*, 69-88.
- Lightbody, P., & Durndell, A. (1993). *Senior school pupils' career aspirations: is gender an issue?* Paper presented at the London conference of the British Psychological Society.
- Littleton, K., Ashman, H., Light, P., Artis, J., Roberts, T., & Oosterwegel, A. (1999). Gender, task contexts, and children's performance on a computer-based task. *European Journal of Psychology of Education, 14*(1), 129-139.
- Littleton, K., & Hoyles, C. (2002). The Gendering of Information Technology. In N. Yelland & A. Rubin (Eds.), *Ghosts in the Machine - Women's Voices in Research with Technology* (pp. 3-32). New York: Peter Lang.
- Lockheed, M. E. (1985). Women, girls, and computers: A first look at the evidence. *Sex Roles: A Journal of Research, 13*, pp. 115-122.
- Machover, K. (1951). Drawing of the human figure: a method of personality investigation. In H. H. Anderson & G. L. Anderson (Eds.), *An Introduction to Projective Techniques*. Englewood Cliffs, N.J.: Prentice-Hall.

- Mackie, D. M., Hamilton, D. L., Susskind, J., & Rosselli, F. (1996). Social psychological foundations of stereotype formation. In C. N. Macrae, C. Stangor & M. Hewstone (Eds.), *Stereotypes and stereotyping* (pp. 41-78.). New York: Guildford Press.
- Makaris, V. (1993). Gender and computing in schools in Japan: The 'we can, I can't' paradox. *Computers and Education*, 20(2), 191-198.
- Margolis, J., Fisher, A., & Miller, F. (2000). The anatomy of interest: Women in undergraduate computer science. *Women's Studies Quarterly*, 28(1/2), 104-127.
- Martin, R. (1991). School children's attitudes towards computers as a function of gender, course subjects and availability of home computers. *Journal of Computer Assisted Learning*, 7, 187-194.
- Measor, L. (1984). Gender and the Sciences. In M. W. Hammersley & P. Woods (Eds.), *Life in Schools: The Sociology of Pupil Culture* (pp. 89-108). Milton Keynes: Open University Press.
- Millard, E. (1997). *New Technologies, old inequalities: Variations found in the use of computers by pupils at home with implications for the school curriculum*. Paper presented at the British Educational Research Association Annual Conference September 11-14, University of York, England.
- Morahan-Martin, J. (1998). *Women and girls last: Females and the internet*. Paper presented at the Internet Research and Information for Social Scientists 1998 conference.
- Morse, F. K., & Daiute, C. (1992). *I LIKE computers versus I LIKERT computers: Rethinking methods for assessing the gender gap in computing*. Paper presented at the American Educational Research Association, San Francisco.
- Murphy, P., & Elwood, J. (1998). Gender experiences, choices and achievement - Exploring the links. *International Journal of Inclusive Education*, 1(2), 95-118.

- National Statistics. (2002a). *Living in Britain 2002 :A summary of changes over time (consumer durables)*. Retrieved 9th March, 2006, from <http://www.statistics.gov.uk/cci/nugget.asp?id=823>
- National Statistics. (2002b). *Living in Britain First release: Internet access*. Retrieved 22nd August, 2005, from <http://www.statistics.gov.uk/pdfdir/intacc0702.pdf>
- National Statistics. (2005a). *Broadband and dial-up internet connections*. Retrieved 19th October, 2005, from <http://www.statistics.gov.uk/pdfdir/inte1005.pdf>
- National Statistics. (2005b). *Internet Access*. Retrieved 19th October, 2005, from <http://www.statistics.gov.uk/CCI/nugget.asp?ID=8&Pos=1&ColRank=1&Rank=192>
- National Statistics. (2006). *General household survey*. Retrieved 26th January, 2006, from http://www.statistics.gov.uk/ssd/surveys/general_household_survey.asp
- NCOOnline. (2005). *National Curriculum Online*. Retrieved 19th October, 2005, from [http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6001&Session/@id=D_5tUMAqvYc22VM76mHQks&POS\[@stateId_eq_main\]/@id=3390&POS\[@stateId_eq_at\]/@id=3331](http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6001&Session/@id=D_5tUMAqvYc22VM76mHQks&POS[@stateId_eq_main]/@id=3390&POS[@stateId_eq_at]/@id=3331)
- Negroponte, N. (1995). *Being Digital: Part Three Digital Life, The Post-Information Age: Cyberdock Edition*. Retrieved 17th January, 2005, from <http://archives.obs-us.com/obs/english/books/nn/ch13c01.htm>
- Newman, L. S., Cooper, J., & Ruble, D. N. (1995). Gender and computers: The interactive effects of knowledge and constancy on gender-stereotyped attitudes. *Sex Roles*, 33(5-6), 325-351.
- NGfL. (2005). *The National Grid for Learning (NGfL) portal*. Retrieved 23rd November, 2005, from <http://www.ngfl.gov.uk/>

- Norman, D. A. (1988). *The Psychology of Everyday Things*. New York: Basic Books.
- Nunnally, J. C. (1978). *Psychometric Theory*. New York: McGraw-Hill.
- O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behaviour Research Methods, Instruments, and Computers*, 32, 396-402.
- OECD. (2005). *The Programme for International Student Assessment (PISA)*. Retrieved 24th August 2005, from http://www.pisa.oecd.org/pages/0,2966,en_32252351_32236159_1_1_1_1_1,00.html
- Ofsted. (2005). *Office for Standards in Education*. Retrieved 12th November, 2005, from <http://www.ofsted.gov.uk/reports/>
- Ofcom. (2002). *Consumers' use of the Internet - Ofcom residential survey Q8 February 2002*. Retrieved 1st November, 2005, from <http://www.ofcom.org.uk/static/archive/ofcom/publications/research/2002/q8intr0402.htm#ch3>
- Okebukola, P. A. (1993). The gender factor in computer anxiety and interest among some Australian high School students. *Educational Research*, 35(2), 81-188.
- Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Pierce, C. A., Block, R. A., & Aguinis, H. (2004). Cautionary note on reporting eta-squared valued from multifactor anova designs. *Educational and Psychological Measurement*, 64(6), 916-924.
- Pittard, V. (2004). Evidence for e-learning policy. *Technology, Pedagogy and Education*, 13(2), 181-194.

- Preston, G. D. (1995). *The effects of Age on Gender Stereotyping of Computing*. Paper presented at the Proceedings of World Computers in Education Conference, Birmingham, UK.
- Qualifications and Curriculum Authority. (2004). *Information and communication technology: 2002/3 annual report on curriculum and assessment*. Retrieved 2005, 12th February, from http://www.qca.org.uk/downloads/7402_ict.pdf#search='Information%20and%20Communication%20Technology:%202002/3%20annual%20report%20on%20curriculum%20and%20assessment'
- Richardson, J. T. E. (1997). Introduction to the study of gender differences in cognition. In P. J. Caplin, M. Crawford, J. Shibley Hyde & J. T. E. Richardson (Eds.), *Gender Differences in Human Cognition* (pp. 3-29). New York: Oxford University Press.
- Richardson, J. T. E., & Woodley, A. (2003). Another look at the role of age, gender and subject as predictors of academic attainment in higher education. *Studies in Higher Education*, 28(4), 475-493.
- Robertson, S. I., Calder, J., Fung, P., Jones, A., & O'Shea, T. (1995a). *The use of pocket book computers in education: report on the Pocket Book Project (CITE Report No.217)*. Milton Keynes: The Open University.
- Robertson, S. I., Calder, J., Fung, P., Jones, A., & O'Shea, T. (1995b). *IT skills in an English secondary school: A snapshot (CITE Report No. 203)*. Open University, Milton Keynes.
- Robinson, J. P., Shaver, P. R., & Wrightsman, L. S. (1991). Criteria for scale selection and evaluation. In J. P. Robinson, P. R. Shaver & L. S. Wrightsman (Eds.), *Measures of*

personality and social psychological attitudes (pp. pp. 1-16). San Diego, CA: Academic Press.

Rojahn, K., & Pettigrew, T. F. (1992). Memory for schema-relevant information: A meta-analytic resolution. *British Journal of Social Psychology*, 31, 81-109.

Rudd T. (2002). ICT and the reproduction of inequalities: a Bourdieuan perspective. Unpublished PhD Thesis, University of Bristol.

Shashanni, L. (1993). Gender-based differences in attitudes towards computers. *Computers and Education*, 20(2), 169-181.

Shashanni, L. (1994a). Gender-differences in computer experience and its influence on computer attitudes. *Journal of Educational Computing Research*, 11(4), 347-367.

Shashanni, L. (1994b). Socioeconomic status, parents' sex-role stereotypes, and the gender gap in computing. *Journal of Research on Computing in Education*, 26(4), 433-451.

Shashanni, L. (1997). Gender differences in computer attitudes and use among college students. *Journal of Educational Computing Research*, 16(1), 37-51.

Siann, G., Macleod, H., Glissov, P., & Durndell, A. (1990). The effect of computer use on gender differences in attitudes to computers. *Computers in Education*, 14, 183-191.

Spertus, E. (1991). *Why Are There So Few Female Computer Scientists?* : MIT Artificial Intelligence Laboratory Technical Report 1315.

Stevenson, D. (1997). *Information and Communications Technology in UK Schools: An Independent Enquiry*. Retrieved 22nd August 2005, from <http://rubble.heppell.net/stevenson/ICT.pdf>

- Tan, L. (1985). Are computers sex-stereotyped by four year olds? In A. D. Salvas (Ed.), *Communication and change* (pp. 82-85). Balaclava, Victoria: Computer Education Group of Victoria.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage.
- The Compact Oxford English Dictionary. (2005). Retrieved 10th August, 2005, from http://www.askoxford.com/concise_oed/access?view=uk
- Todman, J. (2000). Gender differences in computer anxiety among university entrants since 1992. *Computers in Human Behaviour*, 34(1), 27-35.
- Trochim, W. M. K. (2001). *The Research Methods Knowledge Base* (2nd ed.). Cincinnati, OH: www.atomicdogpublishing.com.
- Turkle, S. (1984). *The second self: Computers and the human spirit*. New York: Simon & Schuster.
- Turkle, S. (1995). *Life on the screen: Identity in the age of the Internet*. New York: Simon & Schuster.
- UCAS. (2005). *Annual Datasets*. Retrieved 27th July, 2005, from <http://www.ucas.com/figures/ads.html>
- Valentine, G., Marsh, J., & Pattie, C. (2005). *Children and Young People's Home Use of ICT for Educational Purposes: The Impact on Attainment at Key Stages 1-4*. Retrieved 26th October, 2005, from <http://www.dfes.gov.uk/research/data/uploadfiles/RR672.pdf>
- Van den Hoonaard, W. C. (1997). *Working with Sensitizing Concepts: Analytical Field Research*. Thousand Oaks: Sage.

Webopedia. (2005). *Online dictionary*. Retrieved 11th October, 2005, from

<http://www.webopedia.com/>

Weiser, E. B. (2000). Gender differences in Internet use patterns and Internet application preferences: a two-sample comparison. *CyberPsychology & Behavior*, 3(2), 167-177.

Williams, S. W., & Ogletree, S. M. (1992). Preschool children's computer interest and competence: Effects of sex and gender role. *Early Childhood Research Quarterly*, 7, 135-143.

Yelland, N. (1999). 'Would you rather a girl than me?': Aspects of gender in early childhood contexts with technology. *Australian Research in Early Childhood Education*, 6(1), 141-152.

APPENDIX A - ICT QUESTIONNAIRE

INFORMATION AND COMMUNICATIONS TECHNOLOGY QUESTIONNAIRE



This questionnaire is designed to find out what **you** think about information technology, especially the Internet. There are no right or wrong answers. The questionnaire is anonymous and your answers will be treated in strictest confidence.

CLASS	
AGE	
ARE YOU FEMALE or MALE?	

• PART ONE

Is there a computer in your home? Please **tick** one box.

YES	
NO	

If 'no' please go straight to Part Two

If 'yes' please answer the following:

Which room is it in?	
What type of computer is it?	
Who does it belong to?	
Who uses it?	
Who uses it the most? (e.g. mum, brother)	
Does your family have internet access at home?	

• PART TWO

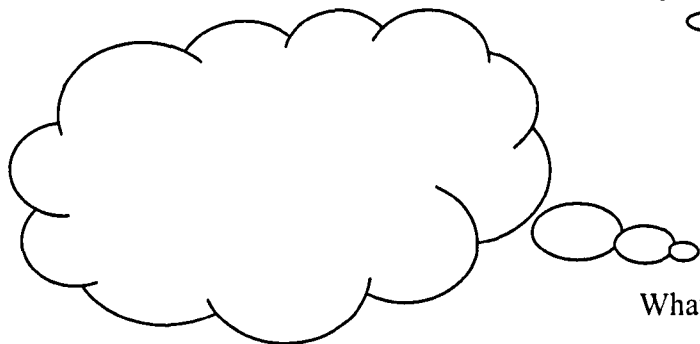
In your bedroom do you have your own (please tick)

radio	
cd player	
cassette player	
television	
games machine (e.g. sony playstation, nintendo)	
video cassette recorder	
computer (e.g. pc, macintosh)	

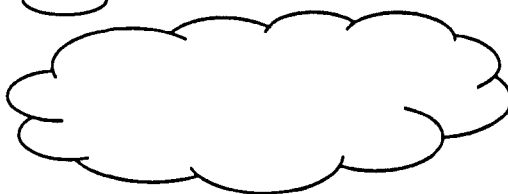
• PART THREE

If you use a computer at home what do you use it for?	
What are your favourite television programmes?	
Do you have a favourite computer game? If yes, what is it?	
What is your favourite sort of music or groups?	

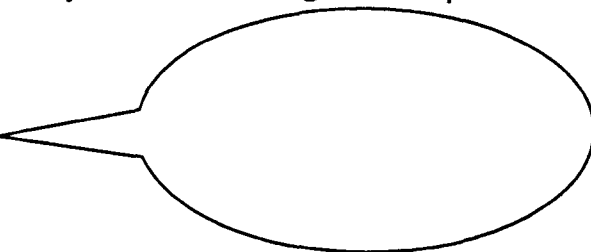
What do you like doing most on a computer?



What do you least like doing on a computer?



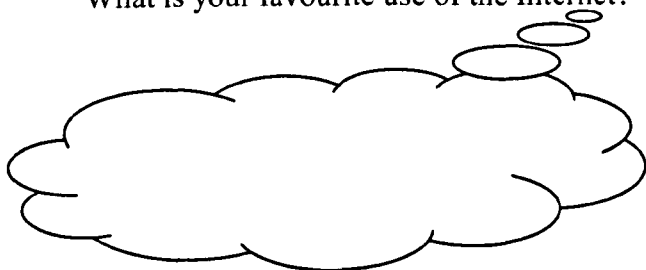
What have you used the Internet for in lessons?



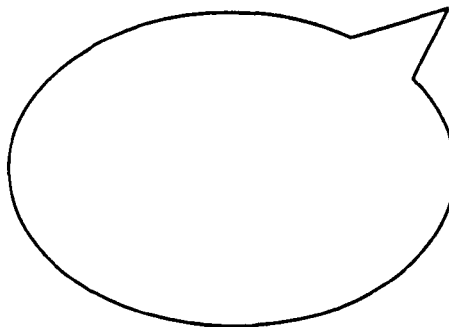
Do you use the Internet outside of lessons?



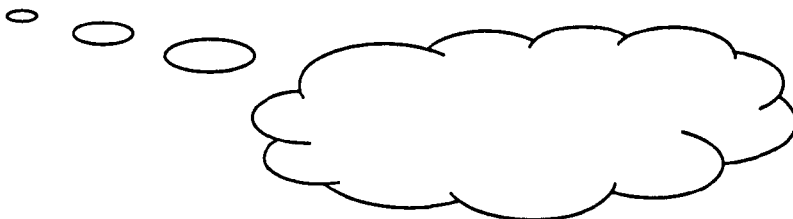
What is your favourite use of the Internet?



If 'yes' what do you use the Internet for?



What do you least like to use the Internet for?

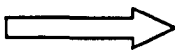


• PART FOUR



TICK the box that expresses **your own opinion** about these sentences:

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
1. When I grow up I would like to use the internet in my work					
2. I hate using the internet					
3. I find it easy to use the internet					
4. Boys like the Internet less than girls					
5. The internet will make the world a better place					
6. The internet has more interesting sites for boys than for girls					
7. I find using the internet difficult					
8. The world would be a better place without the internet					
9. Girls are not interested in the internet					
10. People who use the internet are boring					
11. The internet is less fun for boys than for girls					
12. I enjoy using the internet					
13. Girls use the internet only when they have to.					
14. I wish I never had to use the internet					
15. People who use the internet are fun to be with					
16. Girls are better at using the Internet than boys					

Please TURN OVER the page 

• **PART FIVE**

Somebody is very interested in computers. This person spends a lot of time on the Internet, looking at interesting web pages, joining in chat rooms, sometimes playing games, finding out information for homework, and emailing friends.

What do you think this person looks like? Please do a quick drawing below or write a short description. This can be in any style you choose.

I am interested in your opinions about computers, especially the Internet. Do you have any further thoughts you would like to share with me?

Thank you for answering these questions. This questionnaire is anonymous. If you would be willing to talk to me at a later date please put your name and class here :

.....

APPENDIX B - TECHNOLOGY QUESTIONNAIRE

CLASS	
AGE	
FEMALE or MALE?	

In your home is there a computer? ☐

If 'yes' please answer the following:

Which room is it in?	
What type of computer is it?	
Who does it belong to?	
Who uses it?	
Who uses it the most? (e.g. mum, brother)	
Does your family have Internet access at home?	

In your bedroom do you have your own (please tick)

radio	
cd player	
cassette player	
television	
Games machine (e.g. sony playstation, nintendo)	
video cassette recorder	
computer (e.g. pc, macintosh)	

APPENDIX C – INTERNET QUESTIONNAIRE (ICT-POOR SCHOOLS)

INTERNET QUESTIONNAIRE FOR SCHOOL STUDENTS

This questionnaire is part of a research project on the Internet. *Please complete it carefully on your own using a black or blue biro.* There are no right or wrong answers and you do not have to be an Internet user in order to take part. It is anonymous, we do not need to know your name but we would like to know if you are male or female, so please put a cross in the appropriate box below:

Male ☐

Female ☐

SECTION 1

This section of the questionnaire asks you questions about your use of the Internet at home. *Please answer questions by putting a cross in the appropriate box.*

1. Do you use the Internet at home?

YES ☐

NO ☐

If you answered NO please go to section 2, otherwise continue.

2. Which room at home do you mostly use the Internet from? (Put a cross in one box only)

Family room (eg. lounge, study) ☐

Your own bedroom ☐

Brother's bedroom ☐

Sister's bedroom ☐

Parent's bedroom ☐

3. How often do you use the Internet at home for:

	(at least once a day)	(less than once a day)	(more than once a month)	(less than once a month)	
	LOTS	OFTEN	SOMETIMES	RARELY	NEVER
School related work ? e.g. homework, revision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chat e.g. chat rooms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing Games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at WWW sites that interest you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. When you use the Internet at home, what WWW site topics are your favourites?
(you may have lots of favourites, in which case just give your top three favourites)

SECTION 2

This part of the questionnaire is to find out your own thoughts and opinions about the Internet. Everybody should answer this section. Please put a cross in the appropriate box which most applies to you for each of the sentences below:

	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Not sure</i>	<i>Agree</i>	<i>Strongly Agree</i>
Most of my friends don't use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to have the Internet in my home when I grow up	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet has lots of interesting sites for me	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I am not very good at using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I like to use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is safe to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is difficult to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I feel confident using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't find many interesting sites on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I have made new friends on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I would like to use the Internet in my future work	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I am good at using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to use the Internet in my future work	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I would like to have the Internet in my own home when I grow up	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I haven't made any new friends on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I feel nervous using computers at school	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is easy to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Finally, can you say what sort of work do you want to do when you finish your education?

This questionnaire is anonymous. However, if you would be willing to take part in more research please put your name and tutor group below so that you can be contacted through your school.

.....

If you would like to say more about your thoughts and opinions to do with the Internet please write below:

Thank you for taking part

APPENDIX D – INTERNET QUESTIONNAIRE (ICT-RICH SCHOOLS)

INTERNET QUESTIONNAIRE FOR SCHOOL STUDENTS

This questionnaire is part of a research project on the Internet. *Please complete it carefully on your own using a black or blue biro.* There are no right or wrong answers and you do not have to be an Internet user in order to take part. It is anonymous, we do not need to know your name but we would like to know if you are male or female, so please put a cross in the appropriate box below:

Male ☐

Female ☐

SECTION 1

This part of the questionnaire asks about your use of the Internet at school. *Please answer questions by putting a cross in the appropriate box.*

1. Do you use the Internet at school during lessons?

YES ☐

NO ☐

2. Do you use the Internet at school outside of lessons, for example at lunchtime or after school?

YES ☐

NO ☐

If you answered NO please go to section 2, otherwise continue and answer the following:

3. When you use the Internet at school in your own time where does this usually happen? (Put a cross in one box only)

Classroom ☐

Library ☐

Another Learning area ☐

4. How often do you use the Internet for at school in your own time for:

	(at least once a day)	(less than once a day)	(more than once a month)	(less than once a month)	
	LOTS	OFTEN	SOMETIMES	RARELY	NEVER
School related work ? e.g. homework, revision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chat e.g. chat rooms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing Games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at WWW sites that interest you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Which WWW site topics are your favourites to access from school?
(you may have lots of favourites, but just mention the top three)

SECTION 2

This section of the questionnaire asks you questions about your use of the Internet at home. *Please answer questions by putting a cross in the appropriate box.*

1 Do you use the Internet at home?

YES ☐

NO ☐

If you answered NO please go to section 3, otherwise continue.

2. Which room at home do you mostly use the Internet from? *(Put a cross in one box only)*

Family room (eg. lounge, study) ☐

Your own bedroom ☐

Brother's bedroom ☐

Sister's bedroom ☐

Parent's bedroom ☐

3. How often do you use the Internet at home for:

	(at least once a day)	(less than once a day)	(more than once a month)	(less than once a month)	NEVER
	LOTS	OFTEN	SOMETIMES	RARELY	
School related work ? e.g. homework, revision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chat e.g. chat rooms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing Games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at WWW sites that interest you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. When you use the Internet at home, what WWW site topics are your favourites?
(you may have lots of favourites, in which case just give your top three favourites)

SECTION 3

This part of the questionnaire is to find out your own thoughts and opinions about the Internet. Everybody should answer this section. Please put a cross in the appropriate box which most applies to you for each of the sentences below:

	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Not sure</i>	<i>Agree</i>	<i>Strongly Agree</i>
Most of my friends don't use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to have the Internet in my home when I grow up	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet has lots of interesting sites for me	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I am not very good at using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I like to use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is safe to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to use the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is difficult to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I feel confident using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't find many interesting sites on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I have made new friends on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I would like to use the Internet in my future work	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I am good at using the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I don't want to use the Internet in my future work	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I would like to have the Internet in my own home when I grow up	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I haven't made any new friends on the Internet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I feel nervous using computers at school	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The Internet is easy to use	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Finally, can you say what sort of work do you want to do when you finish your education?

This questionnaire is anonymous. However, if you would be willing to take part in more research please put your name and tutor group below so that you can be contacted through your school.

.....

If you would like to say more about your thoughts and opinions to do with the Internet please write below:

Thank you for taking part

APPENDIX E – CODING SCHEDULE

Four schools:

Two ICT rich = questionnaire style one

Two ICT poor = questionnaire style two (eliminates section relating to school use)

IDENTITY NUMBER	Enter Identity number from top right
QUESTION:	CODING
Do you use the Internet at school during lessons?	YES= 2 NO= 1
Do you use the Internet at school but outside of lessons, for example at lunchtime or after school?	YES= 2 NO= 1 If yes go to = If no go to=
Where in school do you usually access the Internet from in your own time?	CLASSROOM= 3 LIBRARY= 2 ANOTHER LEARNING AREA= 1
What kind of thing do you use the Internet for at school in your own time? a) School related work b) Email c) Looking at WWW sites for your own interest d) Chat	A lot = 5 Often = 4 Sometimes = 3 Rarely = 2 Never = 1
e) Do you use the Internet at school in your own time for anything else?	Letter string
f) What WWW site topics are your favourites to access from school?	Letter string
Do you have Internet access at home?	YES= 2 NO= 1 If yes go to= If no go to=
Which room at home do you use the Internet from?	Family room = 5 Your own bedroom= 4 Brother's bedroom= 3 Sister's bedroom = 2 Parent's bedroom= 1
What do you use the Internet at home for? a) School related work b) Email c) Looking at WWW sites for your own interest d) Chat	A lot = 5 Often = 4 Sometimes = 3 Rarely = 2 Never = 1

e) Do you use the Internet at home for anything else	Letter string
f) What WWW site topics at home are your favourites	Letter string
Most of my friends don't use the Internet	Strongly Disagree = 5 Agree = 4 Not sure = 3 Agree = 2 Strongly agree = 1
I don't want to have the Internet in my home when I grow up	
The Internet has lots of interesting sites for me	
I am not very good at using the Internet	
I like to use the Internet	
The Internet is safe to use	
I don't want to use the Internet	
The Internet is difficult to use	
I feel confident using the Internet	
I don't find many interesting sites on the Internet	
I have made new friends on the Internet	
I would like to use the Internet in my future work	
I am good at using the Internet	
I don't want to use the Internet in my future work	
I would like to have the Internet in my own home when I grow up	
I haven't made any new friends on the Internet	
I feel nervous using computers at school	
The Internet is easy to use	
Are you:	Female = 2 Male = 1
Do you have a computer at home?	Yes = 2 No = 1
If you answered YES, where at home do you usually use the computer?	Family room = 5 Your own bedroom = 4 Brother's bedroom = 3 Sister's bedroom = 2 Parent's bedroom = 1
What would you like to do when you leave full-time education?	Letter string
What is your year and tutor group?	Letter string
Willing to take part in more research?	Yes = 2 No = 1

APPENDIX F – PUBLICATIONS

Publications arising from work for this thesis (earlier papers published under the previous surname of Wood):

Sunley, T.A. (2006) in press. Conceptualising Psychological Access to the Internet: Gender and Attitudes amongst Adolescents. Accepted subject to amendments to appear in: *Journal of Computer Assisted Learning*.

Miller, L., Wood, T.A., Halligan, J., Keller, L., Hutchinson-Pike, C., Kornbrot, D., & deLotz, J. (2000). Saying 'Welcome' is not enough: Women, information systems and equity in work. *Career Development International*, 5, no. 7 pp. 379-389.

T.A.Wood (1999). Psychological Access and the Internet. In G. Cummings, T.Okamoto, & L Gomez (eds), *Advanced Research in Computers in Education: New Human Abilities for the Networked Society* (pp.973-980), Chiba, Japan: IOS Press.

T.A.Wood (1999). *Gender and Educational Equity: The Emergence of the Internet*. (Centre for Information Technology Report.no.247) Milton Keynes: The Open University.

T.A.Wood (1998). *Gender and the 'New Age' of Computers: Identity, Attitudes and Use of the Internet in Education*. (Centre for Information Technology Report no.241) Milton Keynes: The Open University.